

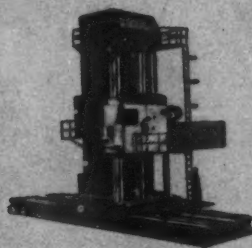
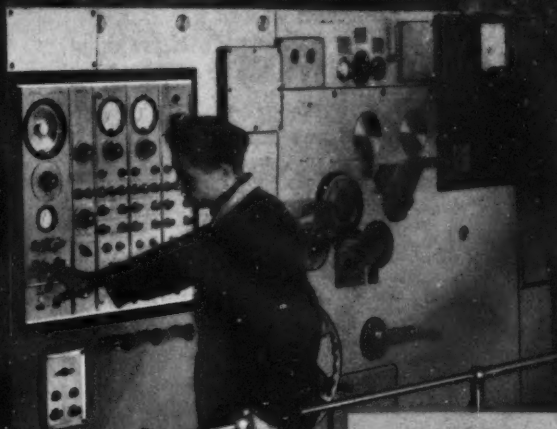
# MACHINERY

JUNE 27, 1958

ONE SHILLING & THREEPENCE



*Horizontal Milling & Boring Machine*



With adequate power and rigidity for heavy-duty milling with carbide cutters. Built in a range of sizes, with spindle diameter 10", 8", 7", 6" or 5".

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. . . the British Isles

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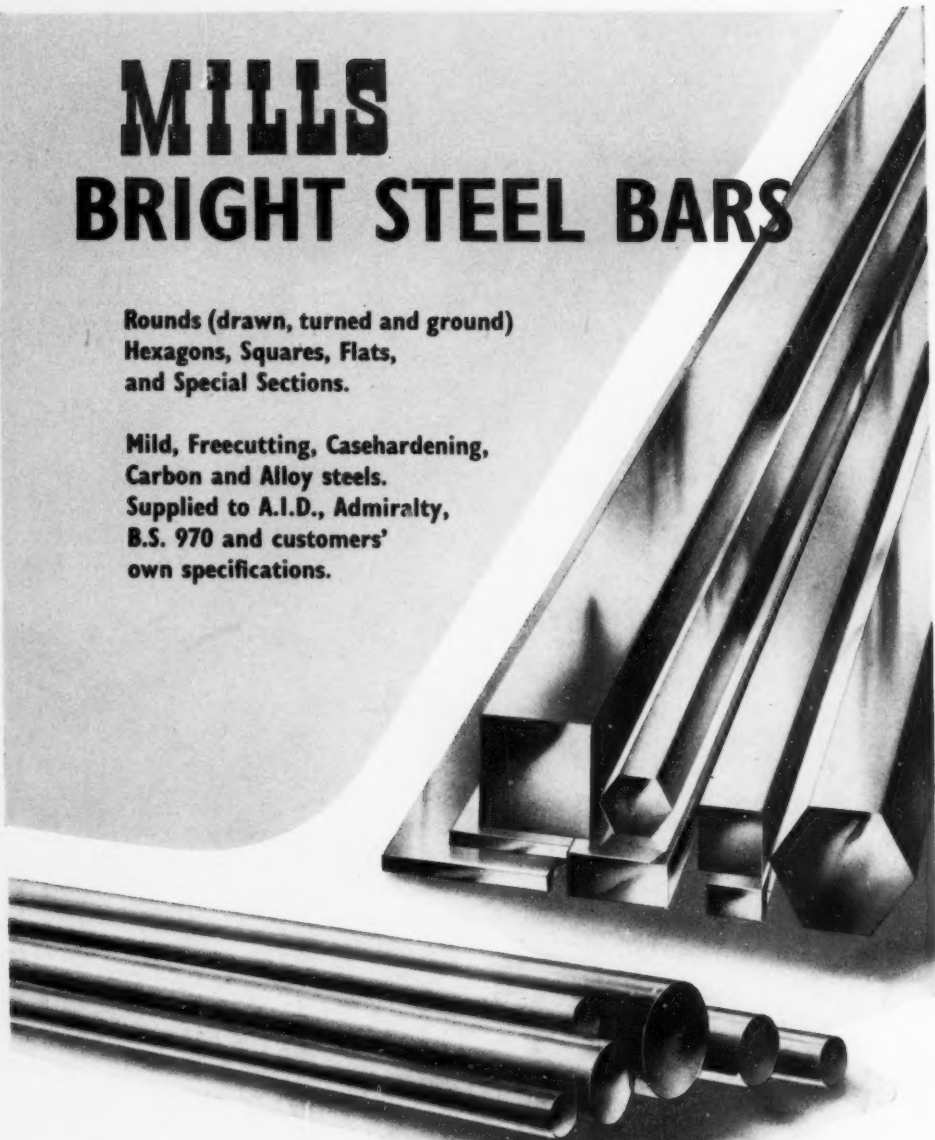
\*Phone: Midland 3431 (7 lines) \*Grams: Maxishope, B'ham. Also at LONDON: Phone: Trafalgar 7224 (5 lines) and GLASGOW: \*Phone: Central 0922

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**Rounds (drawn, turned and ground)  
Hexagons, Squares, Flats,  
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**Mild, Freecutting, Casehardening,  
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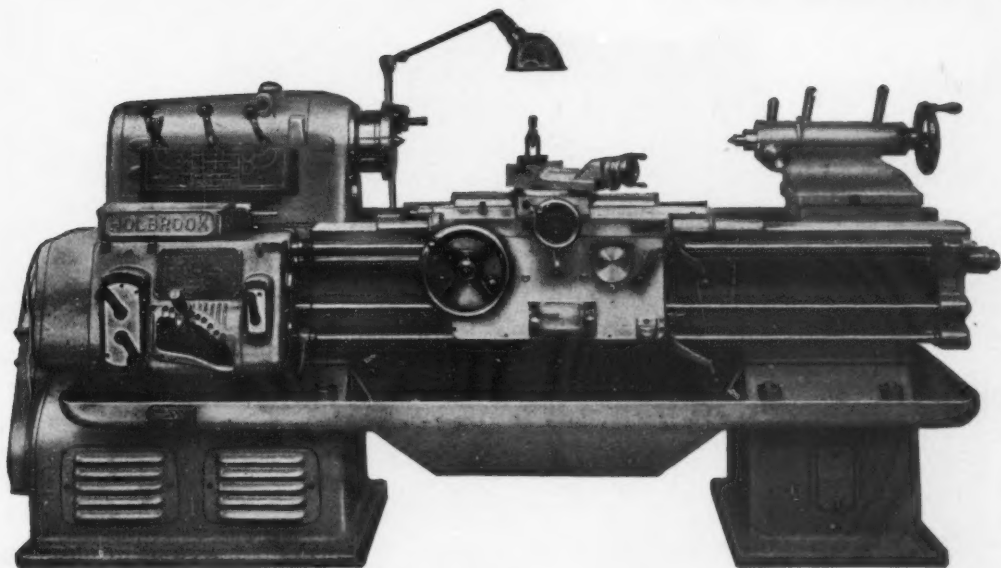
Telephone: WOODLEY 2251. (10 lines) Telegrams: "MILLS" PHONE WOODLEY

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## MODEL "B" PRECISION TOOL-ROOM LATHES

Built in 3 Sizes  
Swinging 13-17-21 inches over Bedways

Cam-lock Spindle Nose  
Synchronizing-Reversing-Clutch for Threading and Feeds - Precision Lead-Screw with  
Compensating End Thrust - Enclosed Apron with Finger Tip Control for Feeds  
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*The Finest Lathe in its Class*

AVAILABLE WITH FULL ADDITIONAL EQUIPMENT

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*Thin Section*

with excellent finish which can  
be vitreous enamelled direct



HARPER No. 1500

*For the production  
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Castings for Harper Food Mincers made on our Mechanised Plant must have a fine silk finish which can be enamelled direct, be sound, strong and easily machined. Accuracy of moulding and coring is essential in the production of these particular castings.



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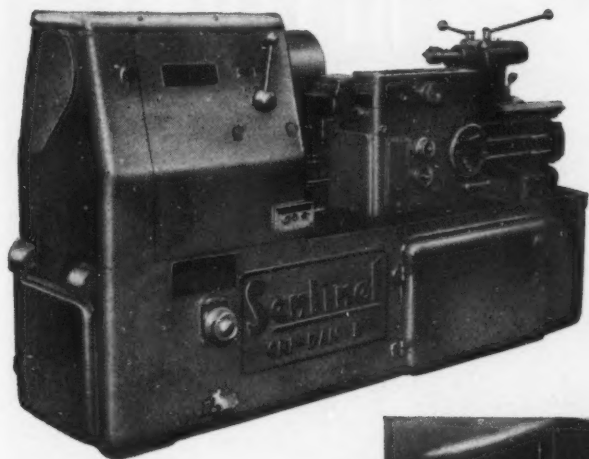
LONDON OFFICE: SEAFORTH PLACE, 57, BUCKINGHAM GATE, LONDON S.W.1 Tel.: TATE GALLERY 0286

MANCHESTER OFFICE: c/o B. J. Brown & Partners Ltd. 248/9 Royal Exchange, Manchester 2

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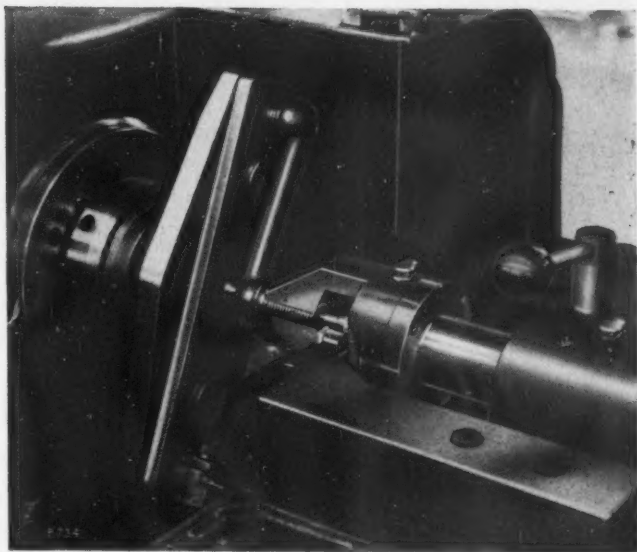
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*cut any type of  
thread—in any  
material that  
can be threaded.*



Threads can be cut in a fraction of the time taken on a thread miller or centre lathe and at less expense with greater accuracy and superior surface finish.

*This set-up on a Cri-Dan type-B is for cutting a  $\frac{11}{16}$ " dia. 11 t.p.i. & 1.390" long thread at both ends of a steering idler at a rate of 48 per hour.*



Over 500 Cri-Dan high-speed threading machines have been installed in customers' works since 1948. This machine combines an old-established principle of cutting a thread with modern tool development. This enables threads to be generated at very high rates of production using semi-automatic cycle and unskilled labour.

Cuts threads up to 5 t.p.i. in mild steel on 4" external and 6" internal diameters and up to 31" in length.

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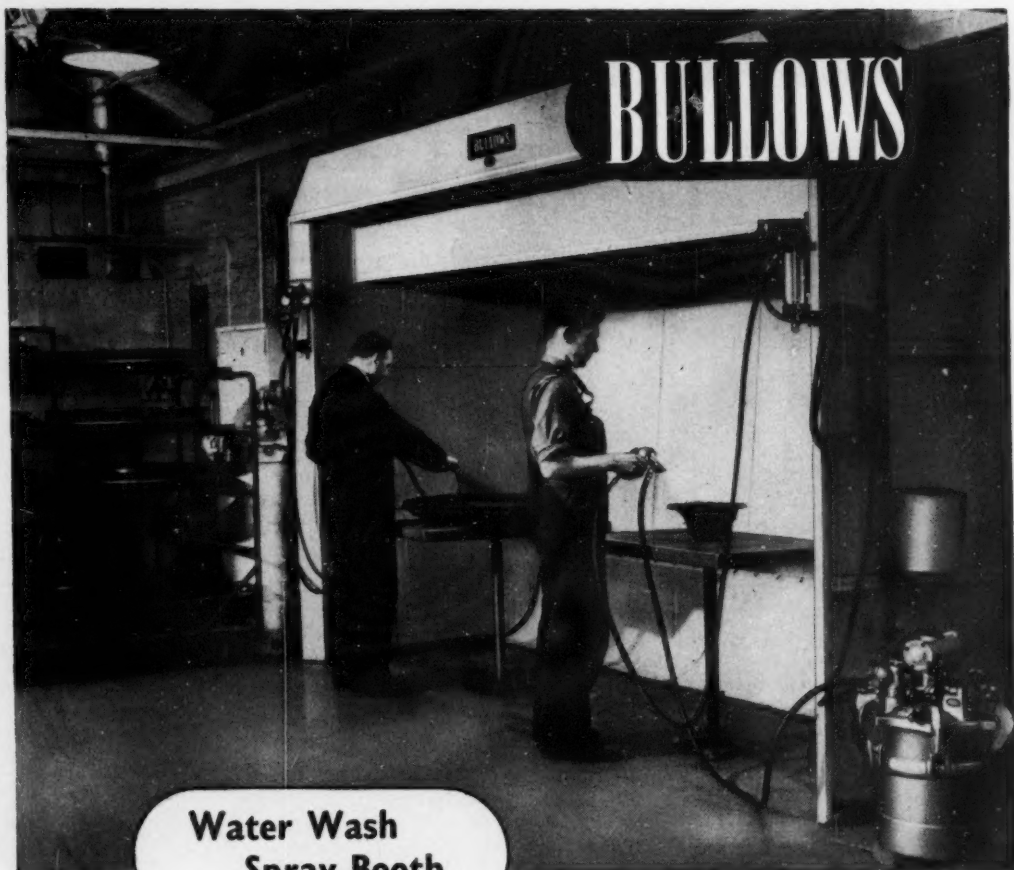
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Consulting us incurs no obligation.*

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AIR COMPRESSORS**



AT **ROLLS-ROYCE** LTD · DERBY

— typical of the many BULLOWS

Spray Booths installed in well-known  
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a famous **Sheffield** name for cutting tools

The name "Wardson" on any small cutting tool gives the operator complete confidence in the quality of work he produces. For over a hundred and twenty years Ward's have been engaged solely in the manufacture and perfection of small cutting tools and their name has become famous the world over to all engaged in the machine tool industry.

#### Ground Flat Stock Rubicon Brand tool bits

These are two other "Wardson" specialities guaranteed always to be of consistent high quality giving utmost satisfaction to the user.

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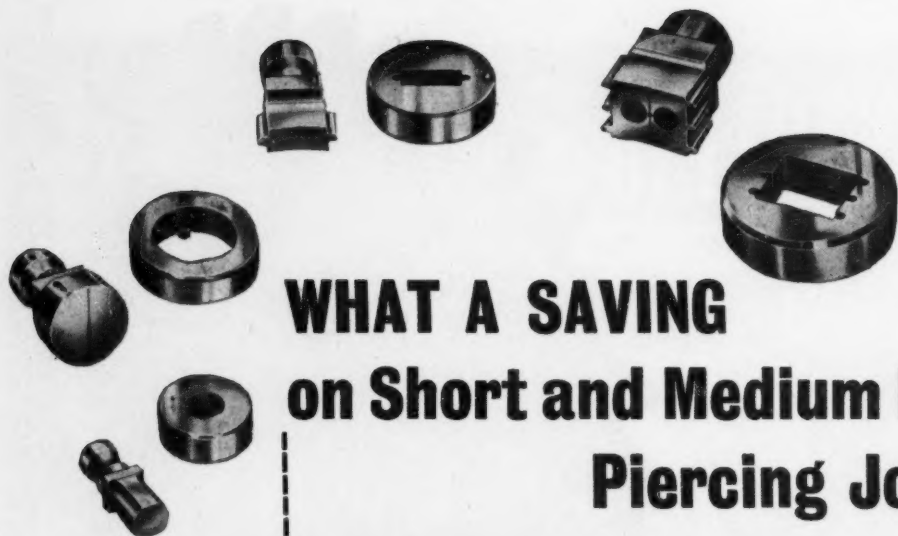
**WM. WARD & SON (SHEFFIELD) LIMITED**  
(Est. 1835)

Centenary Works, Woodseats Road,  
Sheffield 8, England

Telephone: 52451 (2 lines). Telegrams: "Wardson, Sheffield 8"  
Registered Trade Marks: "Wardson." "Rubicon."

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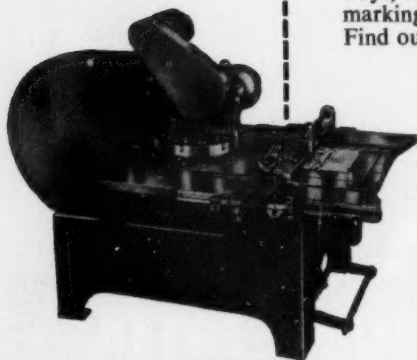
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### BRITISH WIEDEMANN Tooling

Rounds, squares, ovals, clusters and shapes — you use the same tools for every piercing job with similar openings. Every tool is ready for instant use: no setting—always in accurate alignment. The Wiedemann method saves time and expense in other ways, too — reducing handling and eliminating marking out and hand finishing. So why delay longer? Find out more about this economical method today.



There's a  
**WIEDEMANN Turret Punch Press**  
for every short and medium run  
piercing job.

*Hand or power—15,000 to 160,000 lb.  
punching pressure.*

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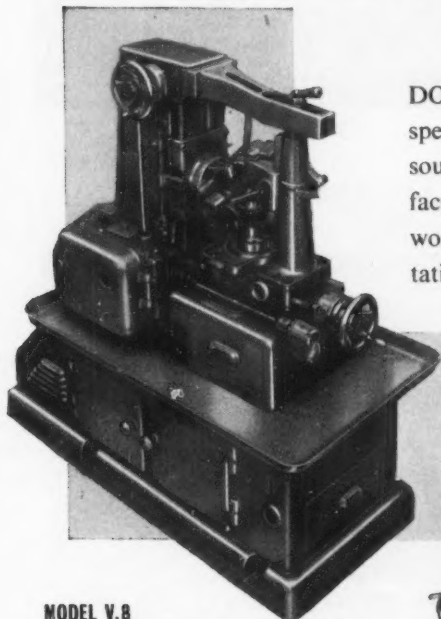
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# HOBGING

—it pays to investigate

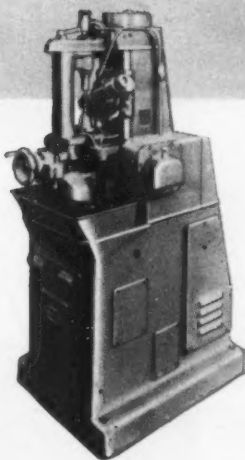


**MODEL V.8**  
**UNIVERSAL HOBGING MACHINE**

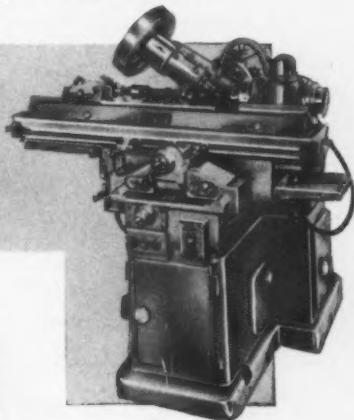
Accurate, versatile, economical. With built-in differential. For spurs, helicals, wormwheels, and worms. Tangential feed and cam operated plunge feed are optional extras. Maximum dia. 8", 7" Face. 12 D.P.

**MODEL V.4**  
**UNIVERSAL HOBGING MACHINE**

Accurate, rigid, and versatile. With built-in differential. For the smaller spurs, helicals, worm wheels, and worms used in light engineering and instrument work. Tangential feed is also available. Up to 4" Diameter, 4" face, 20 D.P.



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**MODEL H.7**  
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Powerful and rigid. With built-in differential. For long splines and gears integral with long shafts, and parallel and taper serrations. Alternative heavy duty or high helix angle hob heads. Maximum dia. 7". Hobbing length 18". 8 D.P.

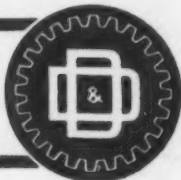
*Ask us to send our new illustrated Hobbing brochure*

**DOWDING & DOLL LTD**

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Because the same cement makes

<p><b>Concrete in hours— not days</b> (using ordinary aggregate)</p>	<p>Mature concrete at unequalled speed. The <i>maximum</i> waiting time is 24 hours.</p>
<p><b>Corrosion-resistant Concrete</b> (using ordinary inert aggregate)</p>	<p>Concrete highly resistant to chemical attack.</p>
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<p><b>Insulating Concrete</b> (using lightweight aggregate)</p>	<p>Jointless castable insulation suitable for high temperatures.</p>



*Send for literature on the application in which you are interested.*

FOR SPEED · STRENGTH  
RESISTANCE · REFRACTORINESS

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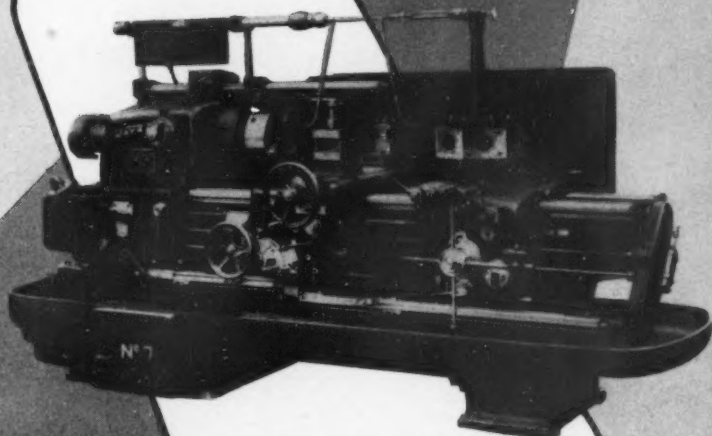
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## No.7 'PRELECTOR' Turret Lathe

**Ward**



- Patent hydraulic pre-selecting head-stock
- 12 spindle speeds, both forward and reverse, (25-1,000 r.p.m.)
- Bed protected by stainless steel covers
- Screw-cutting motion
- Automatic lubrication
- Quick power traverse
- 2½ in. bar 16 in. swing

Full details of our complete range of Capstan and Turret Lathes on request.

**H. W. WARD & CO LTD**

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W667

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**NEW DESIGN**

**KENDALL & GENT**

**PLANO-MILLING MACHINE**

Capacity 6 ft wide x 6 ft high x 18 ft long.  
Infinitely variable speeds and feeds.

- More Power
- Remote Control
- Easier Operation
- Protected Slideways

**KENDALL & GENT LTD**  
MANCHESTER ENGLAND

**KENDALL & GENT LTD**  
**GORTON MANCHESTER**  
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TABLE FEED		MILLING HEAD FEED		L.H. VERTICAL HEAD		R.H. VERTICAL HEAD		HORIZONTAL HEAD	
INCHES PER MIN.		INCHES PER MIN.		R.P.M.		R.P.M.		R.P.M.	

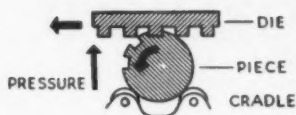
**EMERGENCY STOP** **EMERGENCY STOP**

TABLE TRAVERSE		MILLING HEAD TRAVERSE		CROSS-SLIDE		L.H. VERTICAL HEAD		R.H. VERTICAL HEAD		HORIZONTAL HEAD		OIL PUMP		BRAKE PUMP	

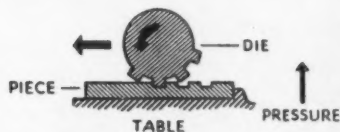
## Deep marking or knurling TOUGH materials . . .



### THE FUNDITOR ROLLING PRINCIPLE



Each round part is located in a cradle and is raised under pressure against a flat die carried in the head. The die then traverses and the impression is made in the part smoothly and evenly.



Each flat part is located in a holding fixture and is raised under pressure against a round die carried in the head. As the die traverses, it rotates, making the impression in the part. In both cases a small portion of the die only is in contact with the piece and positive pressure ensures a consistently clean mark. Shock impact is practically eliminated.

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## Funditor Heavy Duty Marking Mc.

This semi-automatic hydraulic machine has been specially designed for deep marking tough materials without effort. Its rolling action and controlled heavy pressure results in impressions of consistent clarity. By use of the appropriate dies and fixtures deep marking or knurling can be performed with ease and high rates of production obtained by unskilled female operators.

● Send us particulars of your marking or knurling requirements.

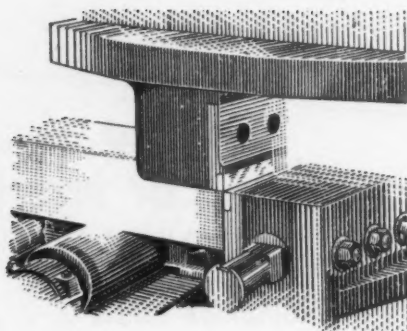
Write for our latest Marking Machine Manual with over 100 illustrations.

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**.. and not in short supply**

**Stellite faced low carbon steel will not only replace alloy steel but will increase life from three to ten times.**

There are hundreds of thousands of applications where Stellite faced low carbon steel is replacing alloy steel, and at the same time giving multiplication of life. Application to hot shear blades is only one of many regularly in use, including pump sleeves, forging dies, clipping beds, mill hammers, steam and refinery valves, press tools, doctor and other knives, cement and rubber screws, chemical plant components, hot glass knives, entry guides, hot extrusion dies, woodworking tools and countless others.



We supply Deloro Stellite hardfacing rod and make certain you get satisfaction by means of our complete service.

*Send for publication B. 9, "Hardfacing with Deloro Stellite".*

**DELORO STELLITE LIMITED**  
HIGHLANDS ROAD, SHIRLEY, SOLIHULL, WARWICKS.  
Telephone : Solihull 2254-5-6      Telegrams : Stellite, Birmingham

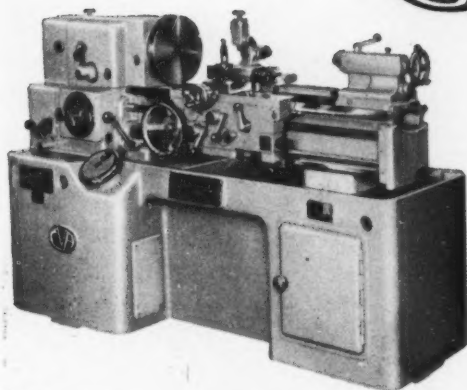
**DELORO ★ STELLITE**  
HARDFACING ALLOYS

ASSOCIATED WITH DELORO SMELTING AND REFINING CO. LTD. DELORO • ONTARIO • CANADA  
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## 1A (MARK III) PRECISION TOOLMAKER LATHE



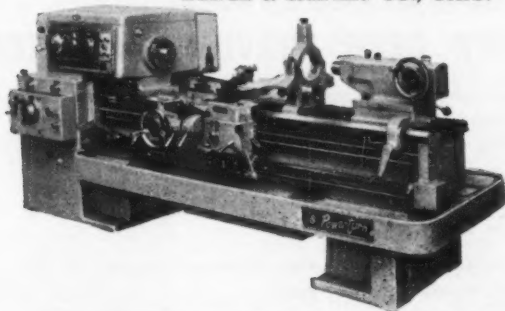
For high surface finish but at the same time, rapid stock removal. The Model 1A swings  $12\frac{1}{2}$ " over the bed and has 30" between centres. Speeds between 25 and 3,100 r.p.m. are available. Power is transmitted from a 4 h.p. main drive motor. Flame hardened bedways ensure continued accuracy over a long life.

# TOOLMAKER



# LATHES

HEAVY DUTY AND STANDARD TOOLMAKER  
LATHES MANUFACTURED BY C.V.A. JIGS, MOULDS  
& TOOLS LTD. UNDER LICENCE FROM THE  
LODGE & SHIPLEY CO., OHIO.



## *Powerturn* TOOLMAKER LATHES

Computing head calculates correct cutting speeds and indicates correct lever settings.

24 Spindle speeds up to 2,000 r.p.m. Alternative motors transmitting up to 20 h.p. through all-spur gearing, with precision bearings. Flame-hardened, replaceable, steel cross-slideways and bedways.

Model 13" swings 18" over bed.

Model 16" swings  $20\frac{1}{2}$ " over bed.

Model 20" swings  $24\frac{1}{2}$ " over bed.

All models available with 54", 78", or 126" between centres.

# E.H. JONES (MACHINE TOOLS) LTD

GARANTOOLS HOUSE  
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Telephone: HOVE 47253 Telegrams: Garantools, Portslade

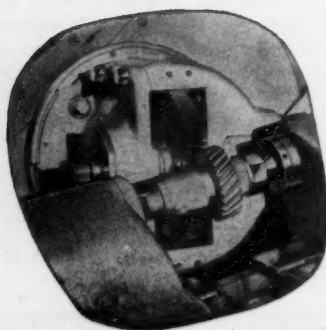
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## PRODUCTION GEAR SHAVING MACHINES



For gear capacities of 7 and 12 inches, these automatic high-speed machines are designed for the rapid shaving of spur and helical gears by the radial loading method, employing the rotary crossed-axis principle.

They are unique in their versatility, since three different shaving techniques can be used.

**AXIAL TRAVERSE** where the cutter traverse is parallel to the work axis, for the wide face gear.

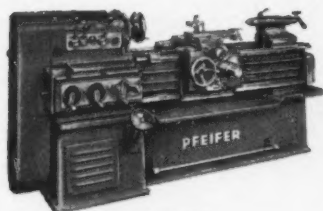
**OBLIQUE TRAVERSE** where the direction of cutter traverse is inclined at an angle to the work axis, for the medium face gear.

**TANGENTIAL TRAVERSE** where the cutter is traversed at 90 degrees to the work axis, particularly suitable for the shoulder gear.

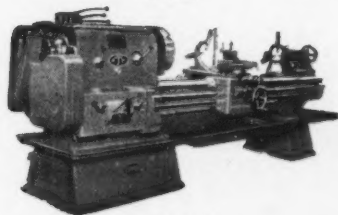
Full details are given in Publication M103-9

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CORPORATION (SALES) LIMITED  
MACHINE TOOL DIVISION  
BRITANNIA WORKS SHERBORNE STREET  
MANCHESTER 5

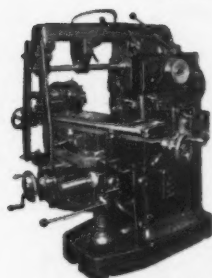
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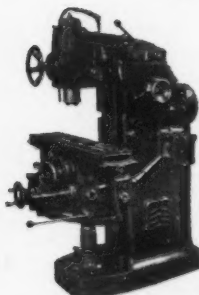
PFEIFER



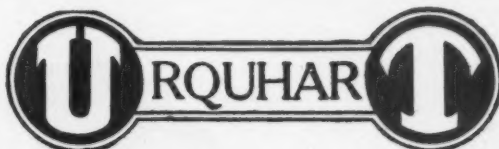
TROGLIA



P.T.V. 51



P.T.V. VERTICAL



## OFFER THE FOLLOWING NEW MACHINE TOOLS !

### PFEIFER PRECISION TOOLROOM LATHE MODEL P 12

9" swing by 40" between, turning accuracy 0.0008", 14 speeds 11 to 1,000 r.p.m., swings 2 1/2" in gap, hollow mandrel 1 1/2", Norton Feed Box, 187 threads, Whitworth Metric and Module, Travelling Steady driving plate, motorised four pole motor, A.C. 415/3/50. Price, £1,275. FROM STOCK. Extras: Taper Turning Attachment, Suds Pump, Fourway Toolpost, etc.

### TROGLIA LATHE TYPE TPM 20

10" centre x 76" between, swings 31" in gap, Hollow Mandrel 2 1/2", 18 speeds, 20-850 r.p.m., Norton gearbox for Whitworth, Metric and Module threads, 4-jaw face plate chuck, 2 steadyies, motorised suds pump, motorised A.C. 415/3/50. Price, £1,100. Equipment inclusive. From stock.

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Capacity 7" x 12", between centres 23 1/2", suitable for horizontal surface grinding 10" x 2", and vertical surface grinding 12" x 4", motorised A.C. 415/3/50. Price, £267 10s. Od. from stock. Ditto De Luxe Model W.S.2. £385 Os. Od. from stock. Extras: Motorised Workhead, Relief and Spiral Grinding Attachments, Collets, etc.

### S.P.W. TAP AND DIE RELIEF GRINDING ATTACHMENT

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2A-1/50 for taps up to 4" x 12 1/2" long, 1" shank, £275 Os. Od.  
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1A-3/50 for taps up to 8" x 13 1/2" long, 2 1/2" shank, on application.

### SURE UNIVERSAL GRINDER

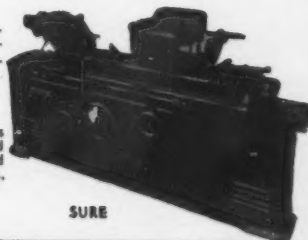
10" swing x 40" between centres, with internal attachment, 13 1/2" dia. wheel, swivelling 90°, motorised workhead, 80-500 r.p.m., swivelling 90°, motorised A.C. 415/3/50, 10" x 40". £1,565 Os. Od.  
10" x 24" £1,375 Os. Od. Early delivery.

### SIMON TOOL LAPPING MACHINE

For Tungsten & Carbide Tools. Accurate radius lapping. Chip breaker and flank lapping. Rough and finish lapping at one setting. Patent combination head with diamond wheel. From stock. Send for details.



FRIKLA



SURE

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TELEPHONE: BALHAM 8551 (5 LINES)



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**Write for this new book** containing full detailed information including:—

**Automatic and hand-operated lubricators.**

**Rotary and reciprocating drives.**

**Dimensioned drawings of lubricators, valves and fittings.**



# TECALEMIT

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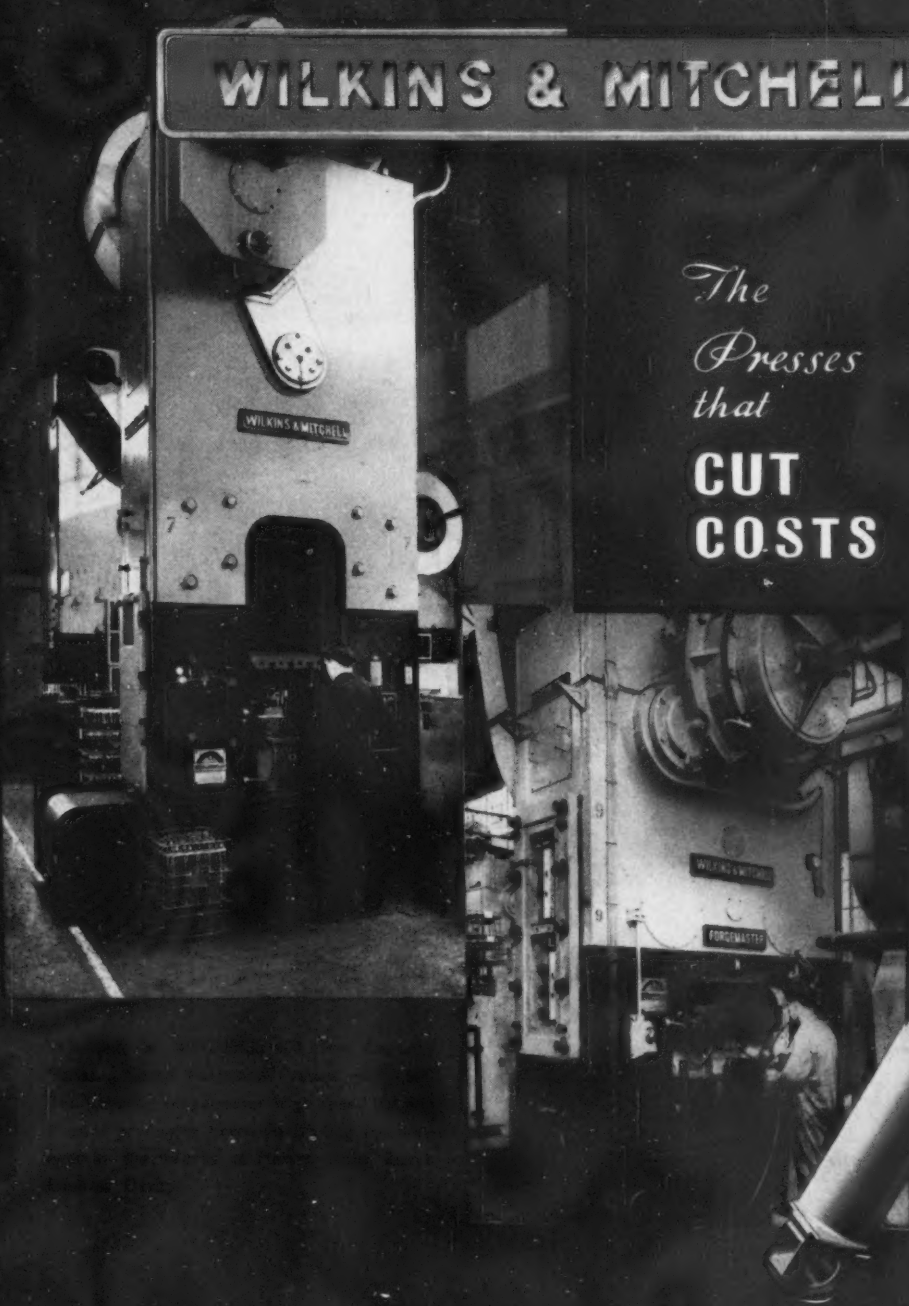
Tec41A

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# WILKINS & MITCHELL

*The  
Presses  
that*

**CUT  
COSTS**





## MACHINING

Machining small bracket on Kearns  
'S' type Facing Chuck Model

## OPERATIONS

Snout and Line Boring — Automatic  
Surfacing — Face Milling — Turning  
— Drilling ... all at one setting

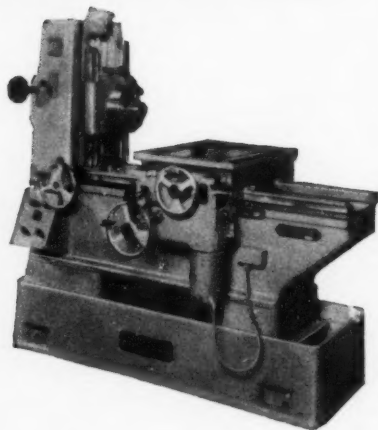
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# Kearns

## 'S' TYPE

### BORING MACHINE

*— almost a workshop in itself*



H. W. KEARNS & CO LIMITED BROADHEATH near MANCHESTER

KSG 1

*When answering advertisements kindly mention MACHINERY.*

*the 12 INCH*  
**MICROBALL**  
**HEIGHT GAUGE**  
*for every industry*



### A NEW APPROACH

This revolutionary height gauge has been designed to satisfy the exacting standards demanded by contemporary times and represents an answer to the ever-increasing difficulties arising from intensive production and automation with often only semi-skilled staff available. The instrument is available graduated in English or metric measure.



The low price brings it within the range of not only the small workshop but the individual toolmaker, inspector machinist, etc.



Send now for full details of this new patented height gauge that you cannot afford to be without

**ALL PRECISION<sup>®</sup>**  
**ENGINEERING Limited**

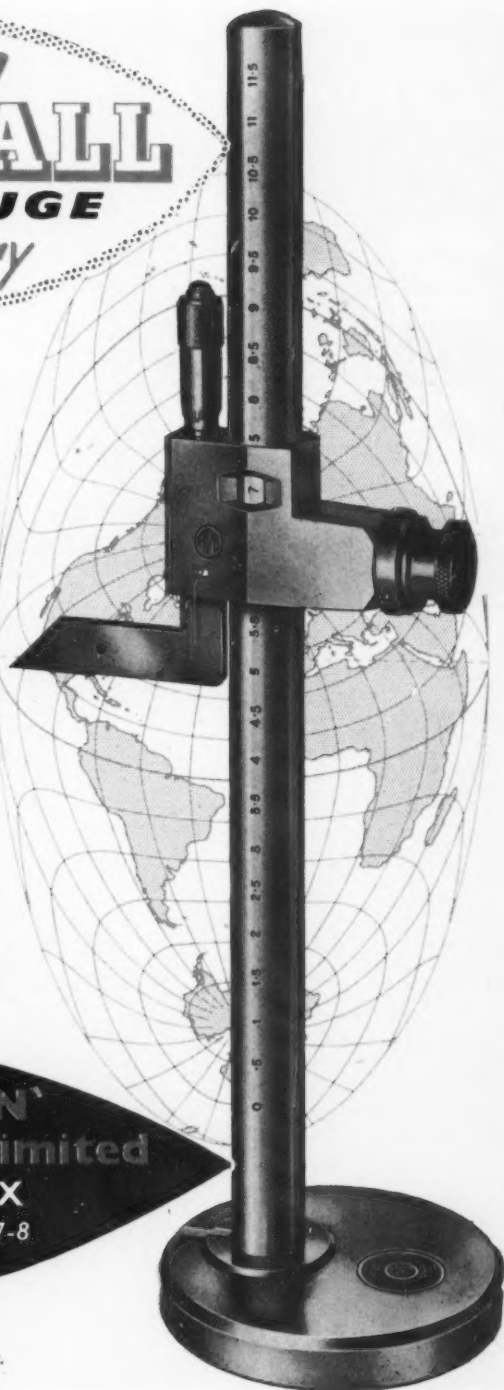
**HORSHAM SUSSEX**

Telephone: HORSHAM 2227-8

**SOLE MANUFACTURERS**

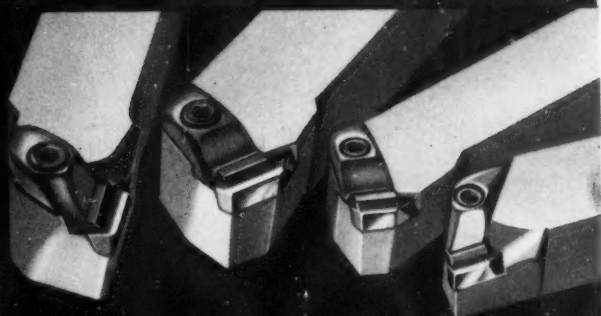
British and Foreign Patents applied for.

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SANDVIK  
*Coromant*

2  
2  
4



## THE COROMANT ADVANTAGE

Coromant tools are the most advanced in the world. They are made of a special alloy of steel and carbide, which gives them a unique cutting edge. This edge is so sharp and strong that it can cut through the hardest materials with ease. Coromant tools are also designed to last a long time, so you can get the most out of your investment.

Coromant tools are the most advanced in the world. They are made of a special alloy of steel and carbide, which gives them a unique cutting edge. This edge is so sharp and strong that it can cut through the hardest materials with ease.

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Coromant tools are the most advanced in the world. They are made of a special alloy of steel and carbide, which gives them a unique cutting edge. This edge is so sharp and strong that it can cut through the hardest materials with ease.

*Coromant*  
**GAMMAX**

**SANDVIK**  
SWEDEN STEELS LTD

4000 LANE, HALLTOWN

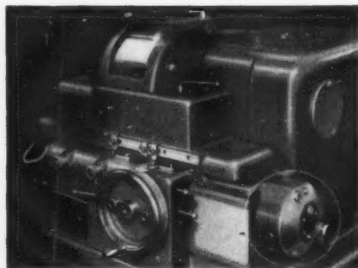
MINNAPOLIS, MINNAPOLIS, MINNAPOLIS

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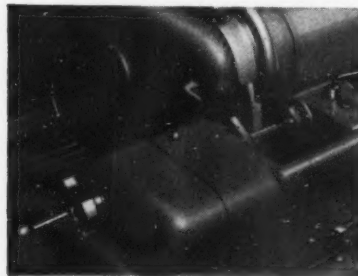
## No. 33 Thread grinding machine



### MACHINE TOOL GROUP



For the production of free cutting ground thread taps, the No. 33 can be supplied with a Relieving Unit giving infinitely variable relief. The Unit is shown on the right of the illustration.



The live workhead and hollow spindle permit work to be ground of overall length beyond the normal capacity of the machine.



1. This small high-precision thread grinding machine has been specially designed to meet the demands of the manufacturer of small scientific instruments.
2. Used throughout the world for thread grinding from the solid blank of ground thread taps, micrometer screws and similar precision components.
3. Threads are produced from a multi-ribbed grinding wheel formed with the famous Matrix Multi-Ribbed Wheel Diamond Dresser or Crushing Unit.
4. Can be fitted with a live centre workhead and hollow spindle enabling work such as long shanked taps to be accommodated.



# Coventry Gauge

& TOOL COMPANY LTD

P.O. BOX 39, COVENTRY, G1 BRITAIN





### THE LINDNER WORM AND THREAD GRINDING MACHINE

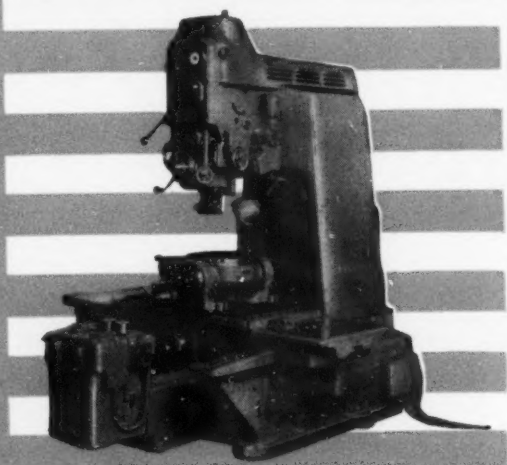
Distance between centres .. 32in.  
 Maximum grinding length .. 20in.  
 Maximum grinding diameter .. 10in.  
 Maximum helix angle right and left 40°  
 External and internal grinding with  
 single and multi-profile wheels.  
 Automatic in-feed grinding.

Other models of thread grinders available for continuous thread up to 13ft.

# LINDNER

### THE LINDNER JIG BORER

- Optical adjustment
- Measuring system free from wear
- Pre-selection of adjustments
- Projection optics
- Open-front design
- Automatic locking and releasing of the co-ordinate table and boring head
- Centralized lubrication
- Setting accuracy 0.00004in.
- Spindle Speeds 25—1900 infinitely variable.



SOLE AGENTS FOR GT. BRITAIN:

**STEDALL MACHINE TOOL CO.**

145-157 ST. JOHN STREET,  
 CLERKENWELL, LONDON, E.C.1  
 Telephone: Clerkenwell 1010 Telegrams: Lockstone-Smith, London

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Measured by  
any standard...

The  
**WILLSON**

**MK. I  
CENTRE  
LATHE**

**STANDS SUPREME... FOR SAFETY  
... PRODUCTIVE CAPACITY  
... ALL ROUND PERFORMANCE**

However you judge a centre lathe—on productive capacity—ease of operation—precision—safety—the WILLSON MK. I will satisfy every demand. The price, too, is surprisingly low, measured by any standard.

Note these features:—

All electrical gear isolated: no-volt release.

Taper and key spindle nose for direct mounted chucks.

Covered bedways—enclosed lead screw and shaft.  
Full protection: gearing inaccessible while running—slipping clutch on feed shaft—shear pin for screw cutting.

**BRIEF SPECIFICATION**

Swing over bed	.. 17½ in.
Swing over cross slide	.. 8 in.
Between centres	.. 24 in.
Spindle speeds (9)	.. 52/954 r.p.m.

**WILLSON LATHES LIMITED**

HALIFAX, ENGLAND

Telephone: HALIFAX 5844-5

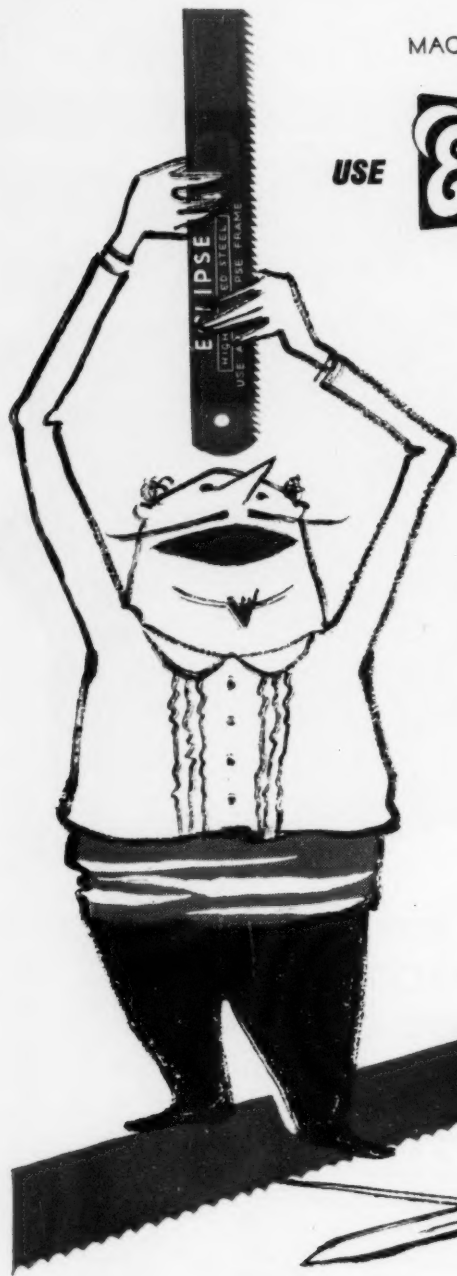


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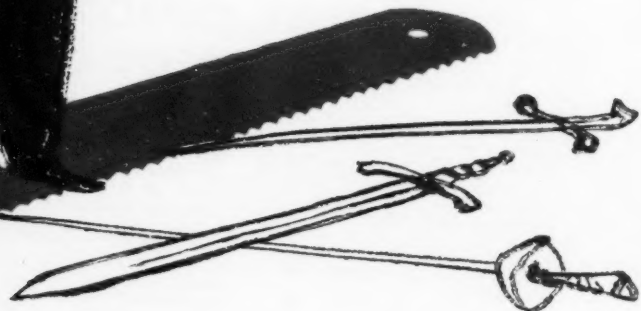
USE



HACKSAW BLADES



**and  
feel  
the  
difference!**

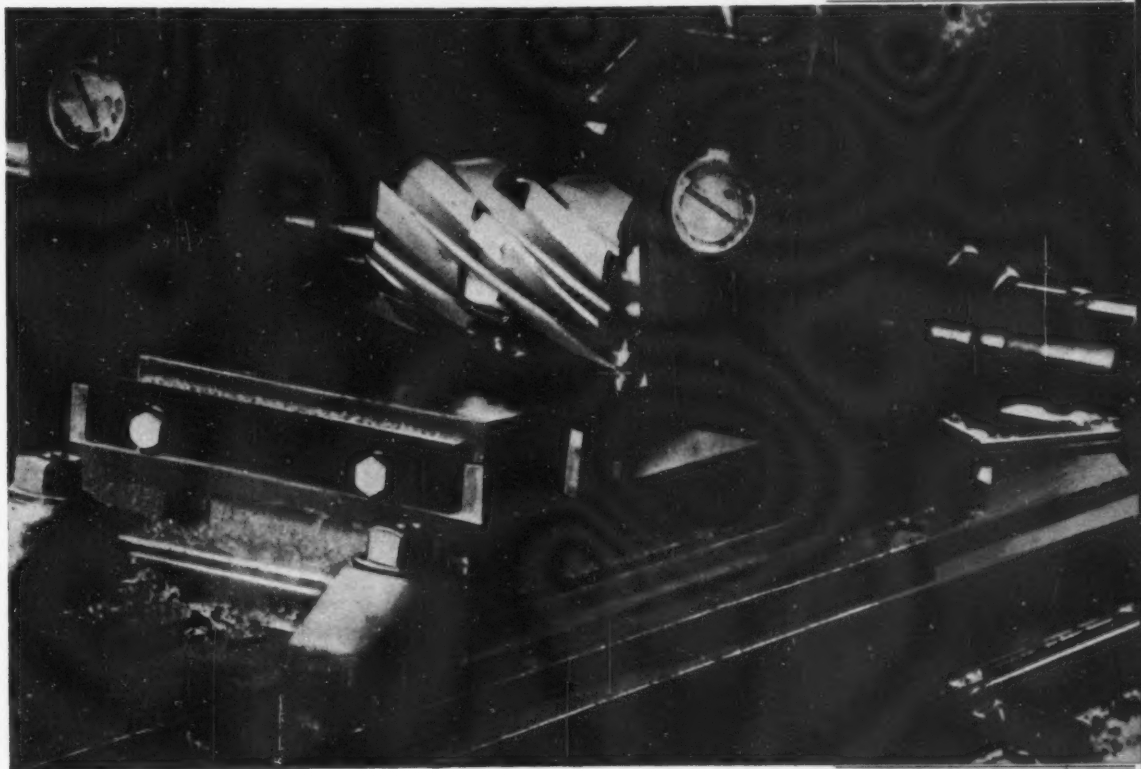


\*Eclipse hacksaw blades and other tools are made by James Neill & Co. (Sheffield) Ltd. and are obtainable from all tool distributors

UH26

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# magnetic chucking



**for greater gripping power**

**gripping right across  
face, side grip as well**

**total magnetic power  
unsurpassed**

# PRATT

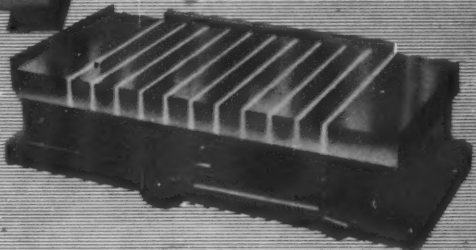
## CHUCKS

**light-durable-strong**

**end & side stop for  
easy, rapid setting**

**precision ground  
surface**

The operation shown illustrates an excellent example of the use of Magnetic Chucks on milling machines. A mild steel plate measuring  $11" \times 5" \times \frac{1}{8}"$  is accurately located by means of the Magnetic Chuck side and end stop plates. Two recess reliefs each measuring  $1\frac{1}{2}"$  wide by  $\frac{1}{16}"$  deep are then gang milled using a cutting feed of  $3\frac{1}{2}"$  per min. The cutting stroke is 8" long, complete floor to floor time of  $4\frac{1}{2}$  min. Setting and clamping time is completely eliminated.



**F. PRATT & CO. LTD., • HALIFAX • ENGLAND**

# COVENTRY ADJUSTABLE REAMERS

- simple, inexpensive  
and efficient.
- can be reground  
many times.



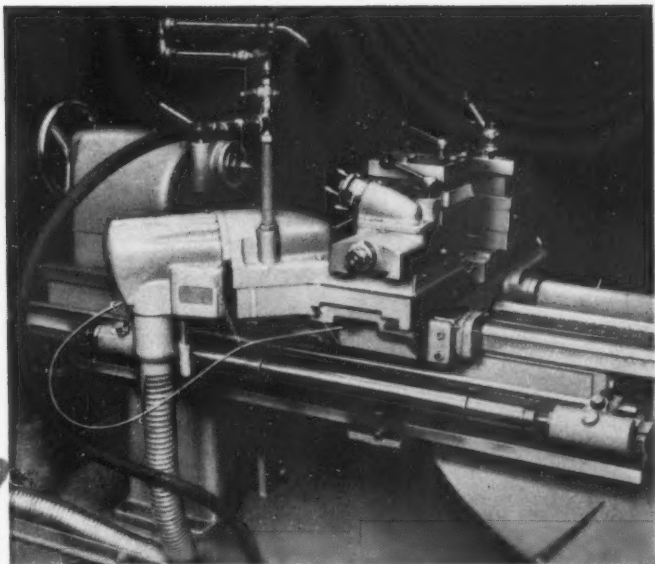
ALFRED

**HERBERT**

LTD., COVENTRY

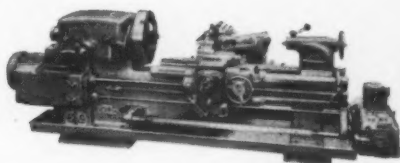
Factored Division, A

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**A SELF  
CONTAINED  
UNIT FOR  
.... CLOSE LIMIT COPYING  
TO NEW AND EXISTING  
CENTRE LATHES**

# THE HEPWORTH Hydraulic



## **COPYING ATTACHMENT**

- DOES NOT IMPEDE THE NORMAL USE OF THE LATHE IN ANY WAY

### NOTE THESE IMPORTANT FEATURES

- Machining times on complicated shapes and batch work greatly reduced.
- The attachment is fitted to the rear of the lathe and does not interfere with the front tool post in any way.
- Fine tapers and radii readily copied and close tolerances maintained.
- Can be used for turning, boring and facing operations.
- Round models or flat templates can be used as masters.

*The above illustrations show the H.I.C. attachment fitted to a Dean, Smith & Grace 21in. Swing Lathe*

OUR EXPERIENCE IS AT YOUR SERVICE

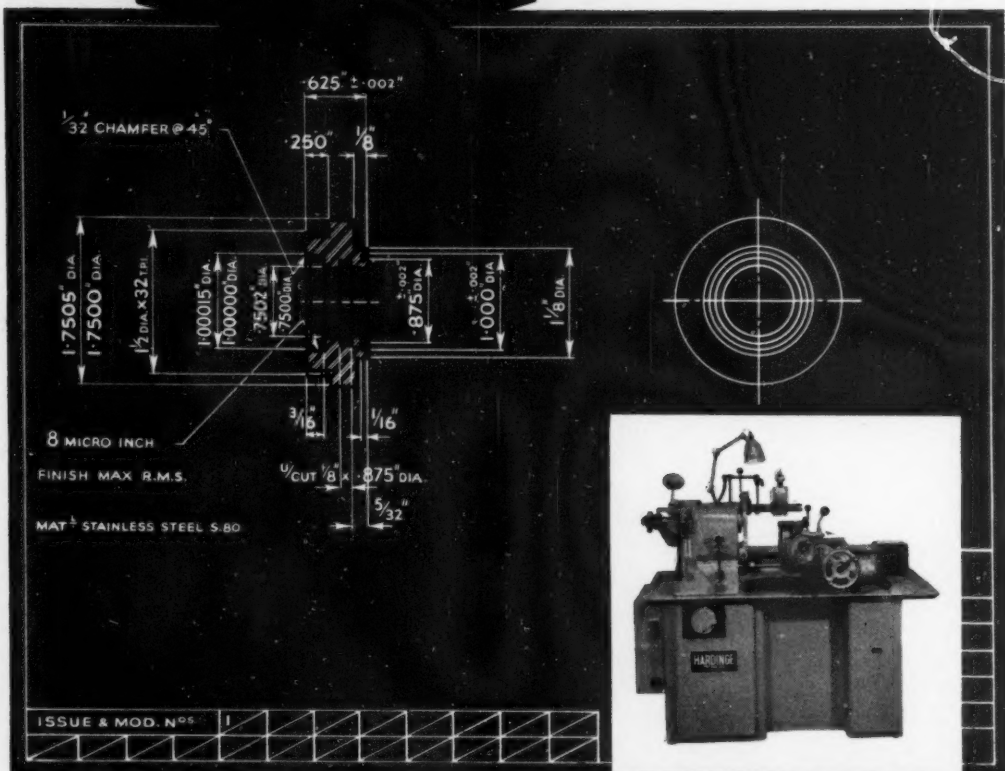
**THE HEPWORTH IRON CO. (ENG) LTD., HAZLEHEAD NR. SHEFFIELD**

TELEPHONE : PENISTONE 3231/5



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## This stainless steel component



The components were fed to the Hardinge HCT Precision Chucking Machine as parted-off and rough drilled blanks, and then machined to final size and finish in a fraction of the time required by conventional methods. Expensive grinding operations eliminated. No special fixtures necessary.

Note these features of Hardinge HCT Lathes: ● Infinitely variable speeds up to 3,000 r.p.m. ● Independent infinitely variable feeds ● Precision 8 station turret indexing through all stations within .0001" repetition. ● Quick setting and standard tooling for economic set-ups on long or short runs ● High speed precision threading with automatic length control, tool lift and return.

Write for full details of Hardinge Precision 8 Station Turret Lathe Model HCT

### Hardinge Machine Tools Limited

One of the Sheepbridge Engineering Group

Feltham, Middlesex Telephone: Feltham 3221/5 Telegrams: Hardinge Feltham

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was produced  
in under 8 min.  
on a Hardinge  
HCT Precision  
Chuckling  
Machine

# WICKMAN S-L-A-S-H

## EXPANSION REAMER PRICES

*The benefit of our lower production cost is yours.*

The considerable demand for Wimet Expansion Reamers has resulted in the introduction of new manufacturing methods. These have led to lower costs which are now being passed to you in the form of lower prices.

Wimet tipped tools already possess a life many times greater than ordinary tools and in the Expansion Reamer this is multiplied many times over by the ability to expand it and regrind to size.

Delivery of all commonly used sizes can be made from stock. Please write or 'phone your enquiries.

### Wimet

**EXPANSION REAMERS**

*Expand it!*

*Grind it!*

*To size again!*

### PRICES

SIZE	Finished Reamers	* Blanks for sizing
	B.S.I. Limits	Grinding Allowance on Nominal +0.030"/0.040"
1/8"	64/3	47/9
3/16"	76/-	58/-
1/4"	84/-	64/6
5/16"	89/3	68/3

\* Blanks for sizing are finished in all respects but left with grinding allowance for circular grinding and backing-off by customer.

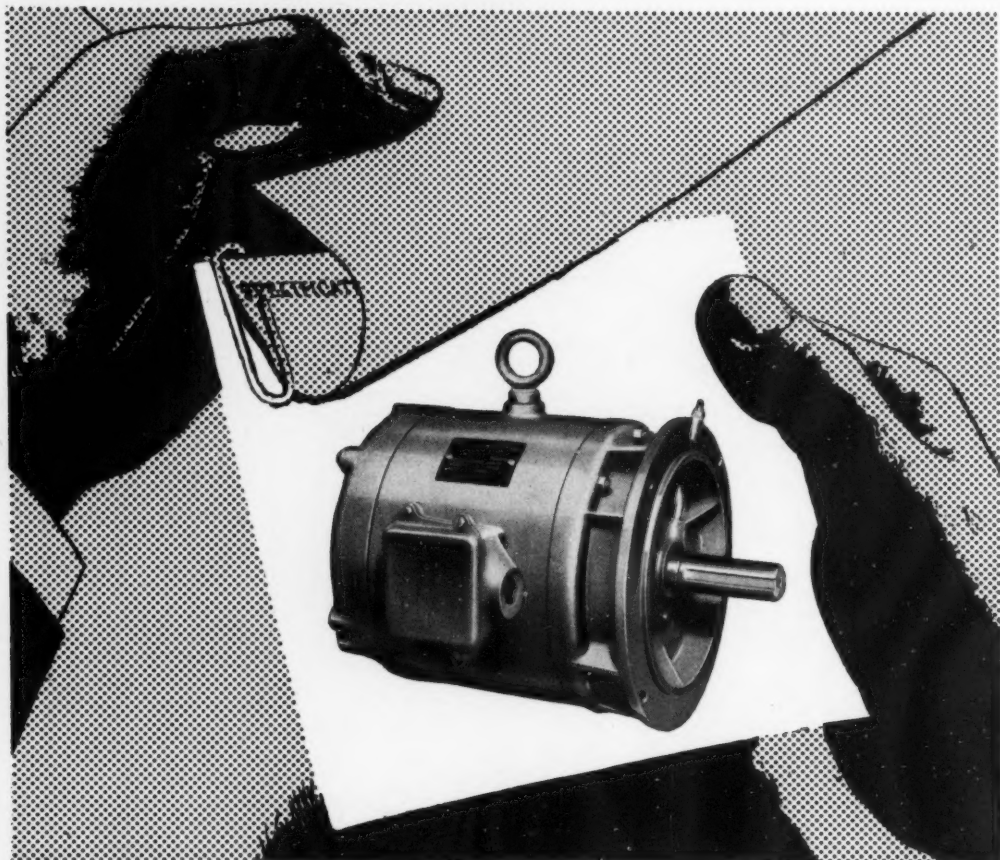
## WICKMAN LIMITED

WIMET DIVISION, TORRINGTON AVENUE, COVENTRY

Telephone: Tiv 66621

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## We tell you all we can, but . . .

Take a Series 5 motor: we can tell you that it conforms electrically to B.S.2613 for Class E insulation and for frame sizes and dimensions to the new B.S.2960; that it costs less; that it is lighter and takes up less space because the frame size is smaller than any previous standard motor of the same horsepower; that the double fan cooling is extremely efficient and the cooling air—exhausted centrally through large openings—leaves with a low velocity that is quickly dissipated. We can tell you what bearings we use and what kind of slot insulation. We can give you all the information in

our power about any other A.C. motor from 1 to 300 h.p. made at our Guiseley Works . . . but still we should not have told you the most important thing—that the motor carries the name . . .

### **Crompton Parkinson** LIMITED

MEMBER OF ATOMIC POWER CONSTRUCTIONS LTD.

*One of the five British nuclear energy groups*

MAKERS OF ELECTRIC MOTORS OF ALL KINDS \* INSTRUMENTS  
ALTERNATORS AND GENERATORS \* SWITCHGEAR  
H.E.T. TRANSFORMERS \* CABLES \* CEILING  
FANS \* LAMPS \* LIGHTING EQUIPMENT  
BATTERIES \* STUD WELDING EQUIPMENT  
TRACTION EQUIPMENT



**CROMPTON PARKINSON LTD., CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2**

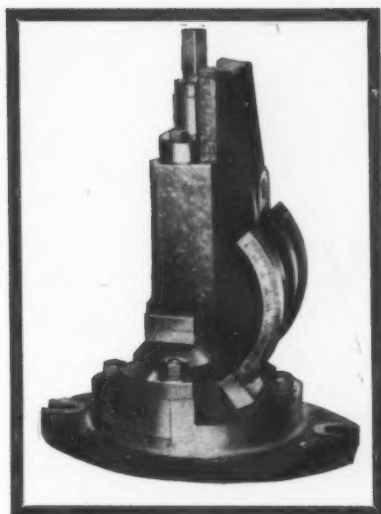
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*Vices for Accuracy  
plus Durability*



## THE ABWOOD UNIVERSAL MACHINE VICES



Suitable for jig boring, grinding, milling and shaping machines. Note the clean design, low height, and rigid mounting. The angle cannot alter once the clamps have been locked. Available in two sizes, 4in. and 6in. jaw widths.

This vice is accurately indexed 0-90° for angular work with spot sight and knife edge for register. The swivel base is indexed through 360° so that any combination of angles may be obtained.

**ABWOOD MACHINE TOOLS LTD. PRINCES ROAD, DARTFORD, KENT**

Telephone : Dartford 5271 (5 lines)

Telegrams: ABWOOD, DARTFORD

UV-1

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★ **CONSISTENCY ... FIRST TO LAST!**



# DORMER

**W**E insist on the most efficient up-to-date machinery to achieve the finest results from each operation. To keep up with our latest production methods, many machines are designed and built in our own Works. **CONSISTENCY** applied to every detail is embodied in each tool marked **DORMER**.

**THE  
SHEFFIELD TWIST DRILL  
& STEEL COMPANY LIMITED  
SHEFFIELD • ENGLAND**

**DORMER TOOLS ARE OBTAINABLE  
FROM YOUR USUAL ENGINEERS'  
MERCHANTS**

# ELLIOTT

# *Excel Again!*

*with* **15°**  
**TILTING**  
**WHEELHEAD**

The new Excel No. 5 has skill built into it; the operator needs very little experience to produce fine work right away, cutting out trial and error.

Duplicated controls cut time still further—and look at the features!



## **EXCEL No. 5**

### **TOOL AND CUTTER GRINDER**

#### **FEATURES THAT MATTER**

- Absolute simplicity of operation.
- Immediate set-up of complicated workpieces.
- Theoretically correct backing off irrespective of diameter.
- Self-contained stator and rotor spindle unit.
- Two speeds—without belt change.
- Maximum operating economy.

Please write for 44 page Machine Tool catalogue

Manufactured by:

**B. ELLIOTT (MACHINERY) LTD**

MEMBER OF THE B. ELLIOTT GROUP OF COMPANIES

Victoria Works, Willesden, London, N.W.10 Tel. ELGar 4050

Overseas Subsidiaries: Canada, U.S.A., Australia, S. Africa

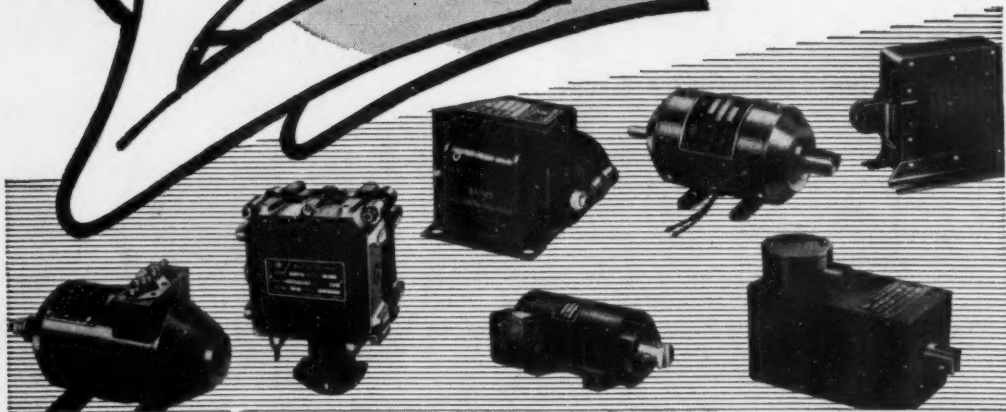


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**don't be prehistoric ...**  
**get a jump ahead with**  
**WESTOOL solenoids**

Whether you make machinery, or simply use machines in your production processes, Westool Solenoids can help you get one jump ahead of your competitors. Westool Solenoids are compact, self-contained, electro-magnetic units which can be fitted anywhere to provide a direct mechanical action automatically, or by remote push-button control. Solenoid action can lift, lower, push, pull, open or shut, thus simplifying machine designs, speeding up operations and reducing production costs.

The list of machines—a long and diverse one—which have been improved by Westool Solenoids includes domestic washers, dry cleaners, can packers, ticket issuing machines, spot welders and concrete batching plant. To meet customers immediate requirements, Westool carry some 10,000 Solenoids of various types and ratings so that your immediate needs may be dealt with by return.



**WESTOOL**  
 LIMITED

**ST HELEN'S AUCKLAND Co. DURHAM**

Telephone: West Auckland 317 (6 lines)  
 Telegrams: Solenoid, West Auckland  
 Birmingham Office: 7 Newhall Street, Birmingham 3  
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Westool also make: Coils & Coils Winding Machines, Transformers & Chokes, Grinding Attachments, Air Conditioners, Warners Electric Brakes & Clutches.

**FLAMEPROOF SOLENOIDS**

Series 500 and Series 700 A.C. Solenoids are available in Flameproof enclosing cases certified to Buxton standards.

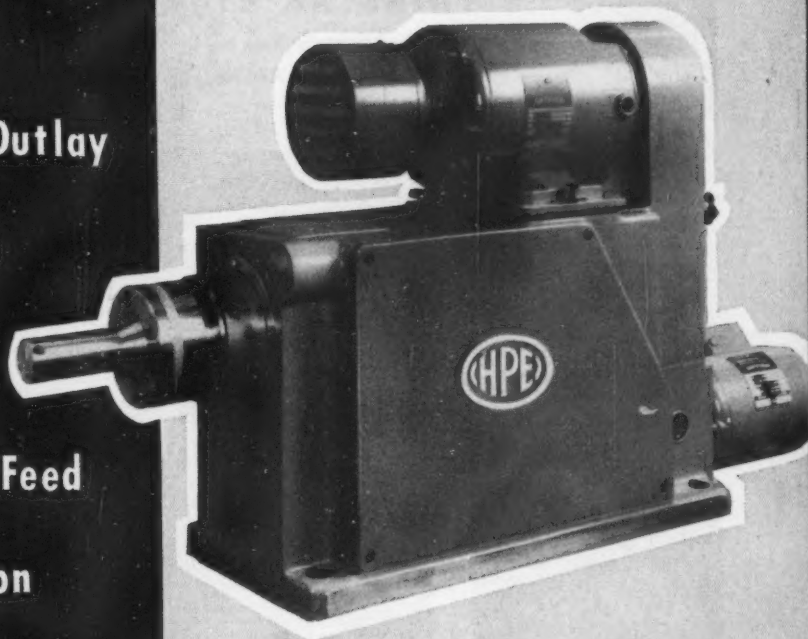


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# THIS IS NEW!

## 100% ACCURACY AND FINISH

- ★ Adaptability
- ★ Low Capital Outlay
- ★ Space Saving
- ★ Integral Cam Feed
- ★ Super Precision Bearings



Manufactured by:—

## High Precision Equipment Ltd

DESIGNERS AND MANUFACTURERS OF SPECIAL  
MACHINE TOOLS

**BLETCHLEY BUCKS**

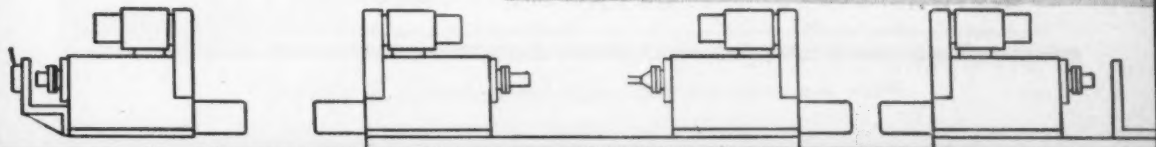
Phone: BLETCHLEY 3403/4/5

The FB4F Fine Boring Unit Head illustrated above incorporates an independent feed motion, transmitted to its spindle quill through a simple plate cam, which can be designed to give a fast approach and varying rates of feed. The robust spindle and quill, together with super precision spindle bearings, ensure a high degree of finish and roundness.

These self contained units are readily adaptable for a wide variety of applications without need for costly set ups.

Particularly suitable for mounting on simple base plates together with the necessary work holding fixture enabling single purpose units to be constructed for the minimum of time and cost. Wide range of speeds and feeds obtainable by changing feed cam and motor pulley.

"Descriptive brochure on request."



## ALIVE TO THE NEW AGE

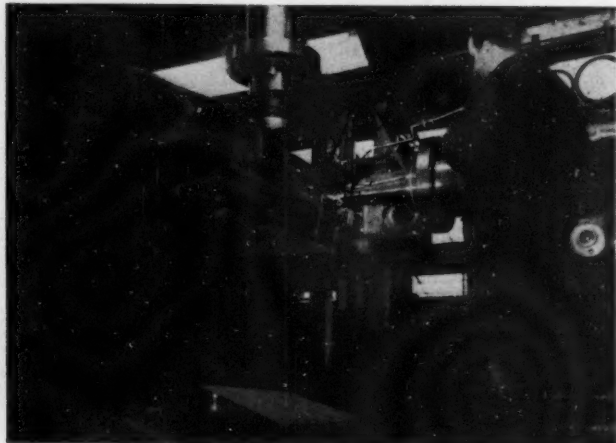
### THINKING BIG? THINK CLARE

The largest milling chuck made, the Clare 'G' size, combined with the renowned Clare tool versatility can show an outstanding saving in change over times on your large machines.

The 'G' size chuck (with maximum collet bore 3" diameter and 5" direct cone mountings) can take from  $\frac{1}{2}$ " to 5" diameter standard end mills and up to 3" diameter x 12" cut long series end mills, up to 14" diameter facing cutters, up to No. 5 Morse Taper Drills, Jobber Drills, etc.



A 'G' size chuck mounting an 8" diameter inserted blade face mill.



Simultaneously facing and tee slotting a Roll Mill Housing (steel casting) on a plano miller, at the works of Davy & United Engineering Co., Ltd., Sheffield. 'G' size chuck on the vertical spindle, mounting a 12" diameter carbide face mill. 'F' size (on a special extension) on the horizontal spindle, mounting a 2½" diameter tee slot cutter.

There is no other chuck made in the world which can equal the capacity or range of the Clare 'G' size chuck.

## CUT BETTER WITH

# "Clare"

## CLARE COLLETS LIMITED

WRIGHT STREET · BROADHEATH · CHESHIRE

Telephone: Altrincham 3701/2

Telegrams: Clarchucks, Altrincham

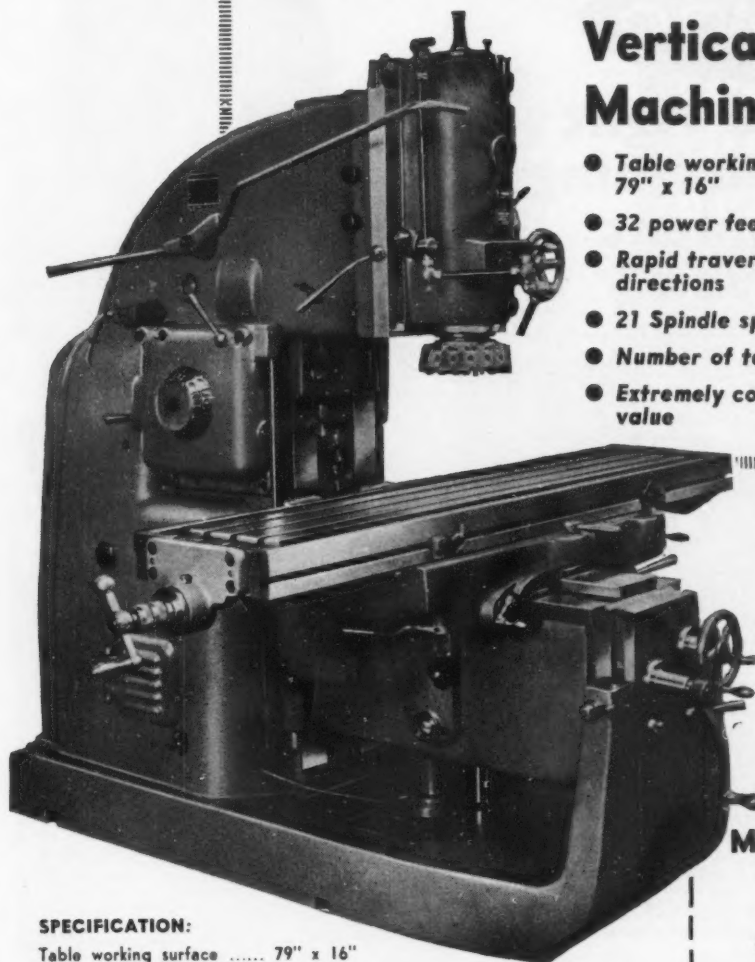
No. 6 of a series  
illustrating the Clare  
Milling System.

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# GIEWONT No. 4

## Vertical Milling Machine . . .

- Table working surface 79" x 16"
- 32 power feeds to the quill
- Rapid traverse in all directions
- 21 Spindle speeds
- Number of table feeds 32
- Extremely competitive value



**MODEL 4 FVA  
DELIVERY  
EX  
STOCK**

### SPECIFICATION:

Table working surface .....	79" x 16"
Maximum distance spindle nose to table .....	20"
Table traverse: Longitudinal ...	42"
Transverse .....	15½"
Vertical .....	14"
Vertical traverse to spindle head .....	6"
Spindle speeds (21) ...	18-1300 r.p.m.
Approx weight .....	5 tons

EXCLUSIVE DISTRIBUTORS IN THE UNITED KINGDOM

**UNIVERSAL  
MODEL 4 FWA  
ALSO  
AVAILABLE  
EARLY  
DELIVERY**

# ELGAR



RIGHT OPPOSITE NORTH ACTON STN.



## MACHINE TOOL COMPANY LIMITED

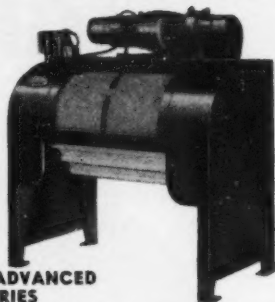
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Midlands Showroom: 1075 Kingsbury Road, Birmingham 24

NRP

FOR DEBURRING • DESCALING • GRINDING • BURNISHING • POLISHING • FORMING RADII  
MICROINCH FINISHING • RUST-INHIBITING • WORK-HARDENING

**ALMCO**

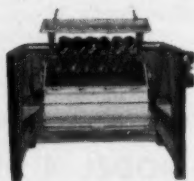
## has the right barrel finishing equipment for you!



Model  
DB 200

### ALMCO'S "ADVANCED DESIGN" SERIES

Thirteen great models in this series! These machines feature a wide range of variable speeds (infinite from 6 to 30 r.p.m.), making possible economical deburring and finishing of the greatest variety of parts. Each unit has Almco's exclusive design features and rugged construction to stand up under all types of punishing applications.



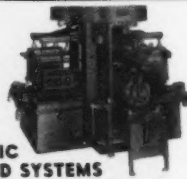
### "FIXTURE" TYPE BARRELS

Pioneered by Almco for processing large and intricate parts. Custom designed fixtures hold parts securely, prevent part-on-part impingement and allow abrasive action to reach all surfaces, cavities, slots, etc. Barrels have automatic forward and reverse controls.



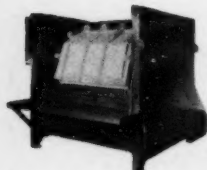
### MULTI-COMPARTMENT BARRELS

Do you have these deburring and finishing problems—wide variety of parts or small quantity runs where fixtures would be too costly? Lack of floor space for several machines? An Almco custom-designed multi-compartment barrel may give you a cost-saving answer. Automatic forward and reverse. Any combination of compartments and doors.



### SUB-O-MATIC AUTOMATED SYSTEMS

Almco's exclusive submerged unit is an automatic, "assembly line" system for micro-precision deburring and finishing of small parts in quantity. Saves labour, speeds up processing and flow of high production parts. One man can operate this equipment and handle as many as 192 barrel loads per 16 hr. day. Slashes compound expense to minimum. These submerged systems can also be obtained in non-automated, straight line systems.



### CUSTOM-DESIGNED BARRELS

Almco designs and manufactures special barrels of all types for problems where standard equipment cannot be effectively used. These range from the smallest type to the largest fixture barrel such as the 60" diameter x 60" length barrel shown above. Special large diameter barrels with double flat or triple flat doors are also available to accommodate extra large parts and to allow abrasive media to flow freely over the outer periphery of the part. Your special problems may be solved with one of Almco's custom-designed barrels.



### SMALLER MACHINES

Twin barrel machines manufactured by Almco are the standard of the industry for processing small lots of parts and for companies with large lots of small parts. Also ideal for sample processing, barrel finishing research and development work. These units are Almco engineered to the highest specification standards and include operational and safety features found on

Model  
DB 01A



**YOUR SAMPLE PARTS PROCESSED** without obligation in modern Almco test labs. Simply send parts direct to Hitchin, Herts. Enclose specifications desired. Complete free report includes recommendation.

Almco deburring and finishing machines are ruggedly constructed to perform on a round-the-clock basis. They incorporate the best engineering design required in the industry—your assurance of versatility and economical processing of work parts. Optional equipment includes material handling devices and systems, automatic forward and reverse, double or triple flat doors, single and dual timer controls for automatic delay starting and stopping, perforated drain doors for flushing and rinsing unloading devices, etc. Also a full and complete line of Almco Superheen barrel finishing compounds and media of all types made especially for use with Almco precision barrel finishing equipment.

**ALMCO Supersheen**

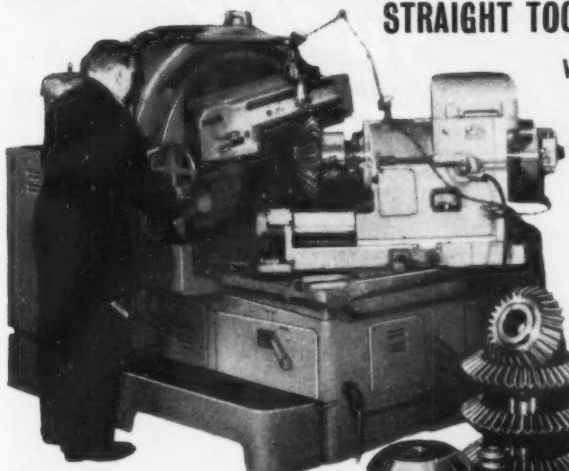
**BURY MEAD WORKS • HITCHIN • HERTS**

Telephone: Hitchin 3669

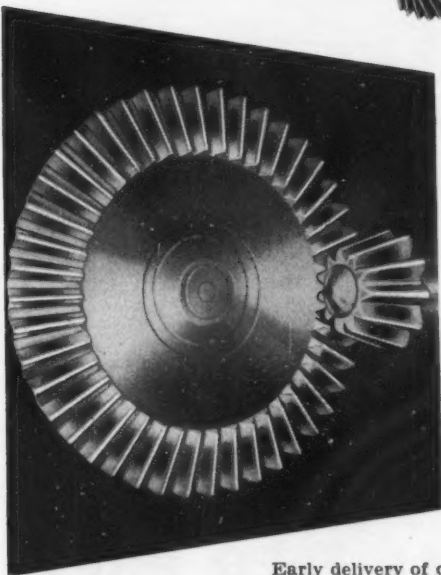
**HOLLAND (Rotterdam)** N.V. Technische Handelssonderneming "Carborundum-Aloxite" • **BELGIUM & LUXEMBURG (Bruxelles)** Technimetal Societe Anonyme • **SWEDEN (Stockholm)** Trumlingsaktiebolaget • **SWITZERLAND (St. Gallen)** L. Kellenberger & Co. • **SOUTH AFRICA (Johannesburg)** Barry Colne & Co. (Pty.) Ltd. • **AUSTRALIA & NEW ZEALAND (Melbourne)** Hardie Trading Ltd.

**INVESTIGATE** the advantages of Precision  
**STRAIGHT TOOTH BEVEL GEARS**  
 with

**LOCALISED  
 TOOTH  
 BEARING**



We are in a  
 unique position  
 to offer this feature.



Gleason No. 24A Coniflex Straight Bevel Gear  
 Generating Machine — the latest addition to our  
 comprehensive range of gear cutting equipment.

Capacity: mitres 25" diameter  
 bevels up to 35½" diameter  
 maximum pitch 1½ D.P.

Your enquiries are invited for bevel gears with  
 localised tooth bearing and also for spurs up to 8' 6"  
 diameter, bevels up to 6' diameter, worms and worm  
 wheels, etc.

Early delivery of complete gears or teeth cut in customers' blanks.

**CAMPBELLS & HUNTER LTD**

**SAYNER ROAD, LEEDS, 10. Telephone Leeds 22397. Telegrams Dolphin, Leeds, 10.**

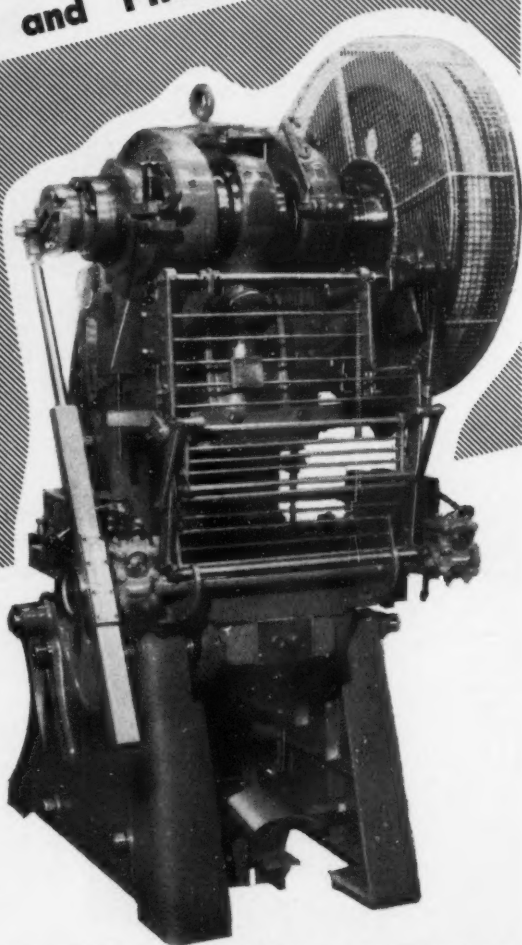
When answering advertisements kindly mention **MACHINERY**.

# Teamed for Production

## HUMPHRIS

### Pressmaster 25 TON PRESS and RACK and PINION ROLL FEED

Although we have supplied a number of our 25 ton presses with rack and pinion type roll feeds fitted, we are illustrating this combination for the first time in an advertisement. In addition to the four feed models in the RF.0600 Series (single and double) and two models in the RF.0900 Series (single and double) which are fitted to this press we now have single and double versions of rack and pinion roll feeds in two widths which are available. In consequence there are now 16 variations of standard roll feeds which can be supplied as attachments to our 25 ton Crank Press and as will be seen from the illustration, interlock guards can be fitted to these presses for use in conjunction with the roll feeds. This important advantage allows the machine to be used for both primary and secondary operations.



## HUMPHRIS

*Pressmaster*

## 25 TON ROLL FEED PRESS

## HUMPHRIS

*pacemakers of progress in presswork*

**HUMPHRIS & SONS LTD • POOLE • DORSET**

TELEPHONE : POOLE 1800

TELEGRAMS : HUMPSONS

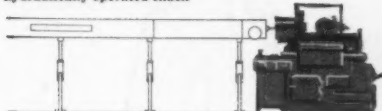


**70%**  
production boost  
for most bar-fed  
machines

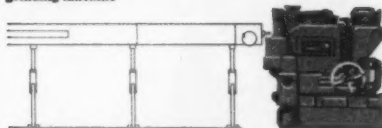
*Here are self-explanatory reasons  
why users report increases up to 70 %  
with the BIRFEED:—*

- 1 Reloading each bar takes only 7 seconds!
- 2 Magazine capacity 12—1" dia. bars
- 3 Magazine loaded by unskilled labour
- 4 No need to stop machine while magazine is loaded
- 5 Skilled operators can attend to more machines
- 6 Random lengths of stock can be used
- 7 Actual productive machining time is increased, and machine tool efficiency can often exceed 85 %

**BIRFEED (high-speed)** adapted to suit electronically controlled automatic with hydraulically operated chuck



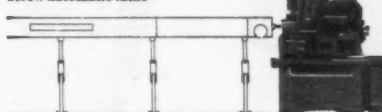
**BIRFEED** attached to centreless grinding machine



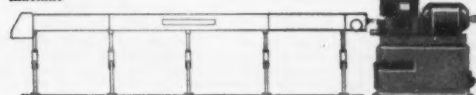
**BIRFEED MK. II** feeding tubular stock to cutting-off machine



**BIRFEED MK. II** supplying single-spindle screw automatic lathe



**BIRFEED MK. IIB (high-speed)** in standard form, feeding bar stock to rotary wheel type cutting-off machine



The BIRFEED Automatic Magazine Bar-feeding Attachment is readily installed: there is only one small modification necessary to the existing mechanism of a bar-fed machine tool. The BIRFEED is adjustable to the centre height of any machine. Standard BIRFEED attachments have been designed to suit the majority of modern capstan lathes, single-spindle screws, automatic lathes, and parting-off machines, but there are numerous other adaptations available to suit this outstanding equipment. Details of the BIRFEED models, including optional extras and adaptations will be forwarded on request.

## Birfield Birfeed

AUTOMATIC MAGAZINE BAR-FEEDING ATTACHMENT

BIRFIELD TOOLS LIMITED · BODMIN ROAD · COVENTRY

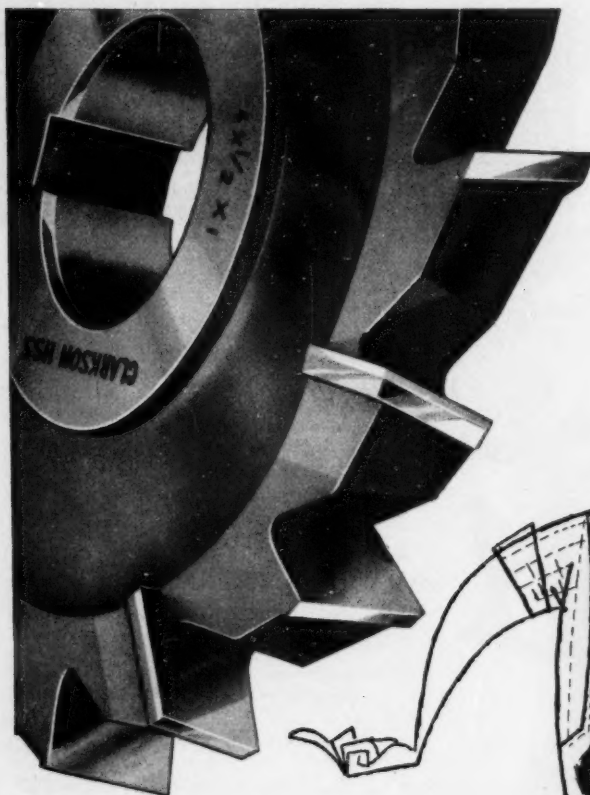
Phone: Walsgrave-on-Sowe 2372

MEMBER OF THE



BIRFIELD GROUP

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## **Clarkson** SPIRAL SIDE AND FACE CUTTERS



## **Clarkson CUTTERS** have the edge ....

with these good reasons

**Better** Clarkson Spiral Side and Face Cutters have the edge on the market because they last longer and have a more consistent life. You know what to expect from Clarksons.

**Cheaper** You get the best for less cost because you buy direct from us—at Makers' prices.

**Faster** You save time and money because Clarkson Spiral Side and Face Cutters operate at higher speeds than standard cutters. Machining time can be reduced as much as 60%.

**Delivery by return** Orders for standard Cutters are executed the same day as receipt. No waiting, no fussing. 46 standard sizes from 3" x 3/16" to 8" x 1", in 1" or 1 1/4" bore, and also in Metric sizes.

### **CLARKSON (ENGINEERS) LTD.**

**NUNEATON** Head Office and Works, Nuneaton 2261 **NEWCASTLE** 241 Westgate Road, 1, NEWCASTLE 2-5248 **LONDON** 124 Hammersmith Road, W.6, RIVERSIDE 8241 **BIRMINGHAM** 15 Heath Mill Lane, 9, VICTORIA 3994 **BRISTOL** 17 Cumberland Street, 2, BRISTOL 2-8464 **MANCHESTER** 98 Oxford Road, 13, ARDWICK 4804 **GLASGOW** 430 Crown Street, C.5, SOUTH 1942 **LEEDS** 8a Britannia House, 1, LEEDS 26369 **BELFAST** 32 Shaftesbury Square

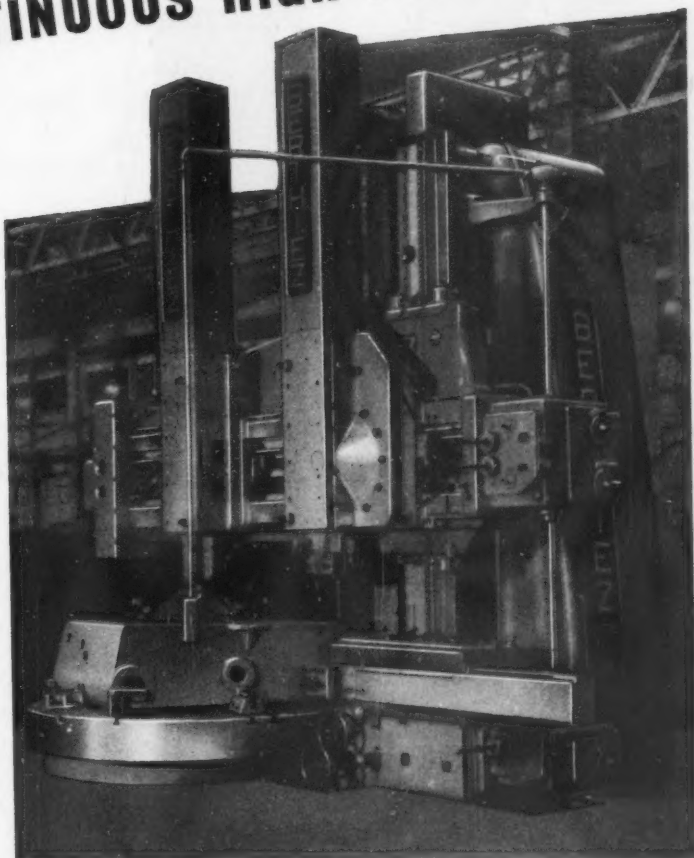
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# BERTHIEZ SINGLE UPRIGHT

## *Vertical Boreers*

— FOR CONTINUOUS HIGH PRODUCTION

● Available with either fixed or sliding table, with a choice of table diameters from 40 in. to 177 in., giving swings of 45 in. to 316 in. according to the type specified



Full particulars and early delivery from Sole Agents:

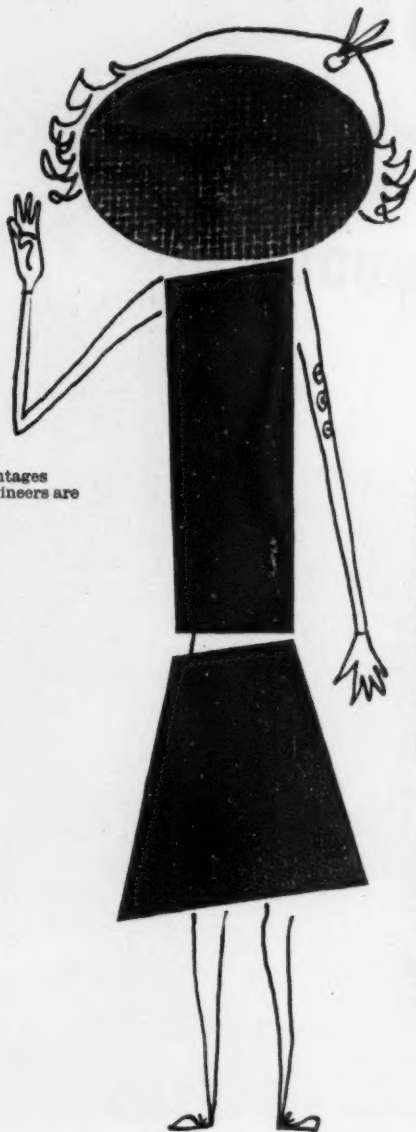


**SOAG MACHINE TOOLS LTD., LONDON**  
**JUXON STREET, LAMBETH, S.E.11**

Phone: RELiance 7201 Grams: SOTOOLSAG, LONDON, S.E.11

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## Guides are made of Ferobestos



A glance at these unique advantages shows why more and more engineers are specifying Ferobestos.

**great physical strength**  
high strength to weight ratio  
high temperature resistance  
low moisture absorption  
good chemical resistance  
high wear resistance  
good electrical resistance  
high dimensional stability  
low coefficient of friction

The versatility of Ferobestos, an asbestos-reinforced plastic material, opens up an extremely wide range of engineering applications. As well as guides these include:—

**Bushes**  
**Coupling Discs**  
**Bearings**  
**Gears & Rollers**  
**Piston Rings**  
**Wearing Slippers**  
**Mounting Pads**  
**Compressor Blades**  
**Thrust Washers**

Ferobestos is available in a number of special grades including silicone impregnated for greater heat resistance and graphite impregnated for more efficient lubrication.

Ferobestos can be supplied from stock in sheets, rods, and tubes. Special mouldings, where quantity justifies the cost, can be made to order. Write for fully detailed and illustrated leaflets.

# J. W. ROBERTS LTD

**FEROBESTOS DEPARTMENT**

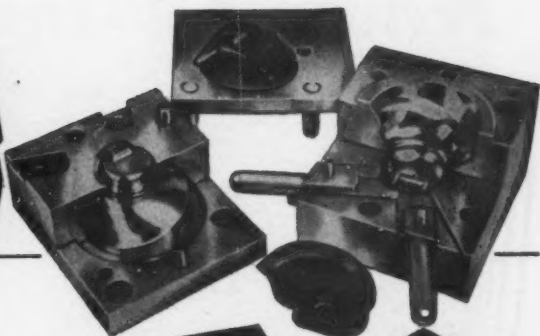
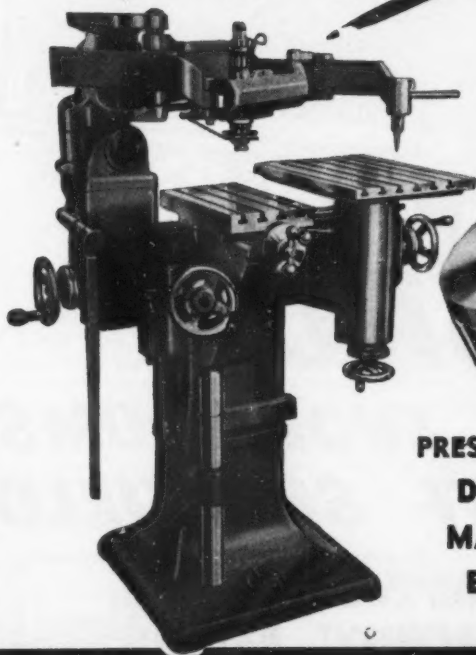
Chorley New Road, Lostock, BOLTON. Tel: Horwich 840 • Branch Sales Offices: LONDON, GLASGOW, BIRMINGHAM, LEEDS

A Member of the Turner & Newall Organisation

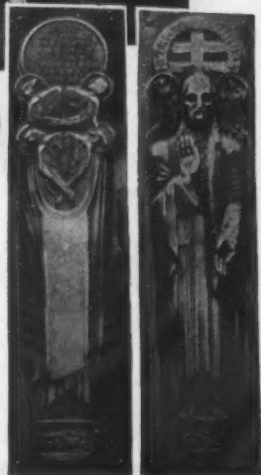
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# GHA

*For two- and three  
dimensional  
reproduction*



**PRESENT DELIVERY  
DIESINKING  
MACHINES—  
EX STOCK**



**GEORGE H. ALEXANDER MACHINERY LTD.**

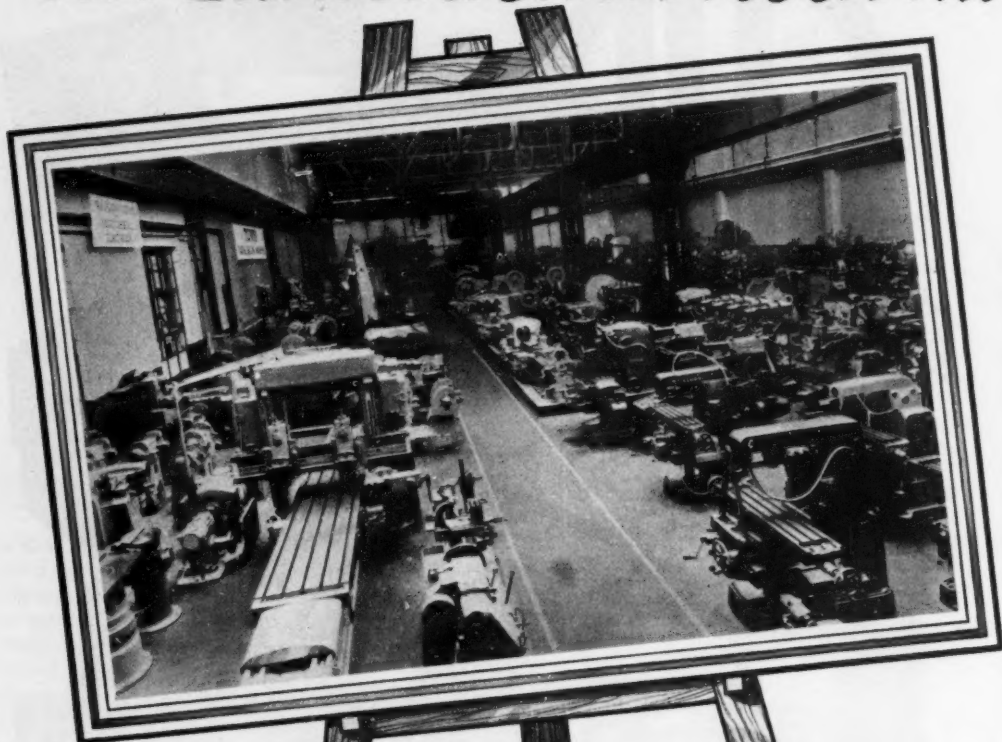
**82-84 COLESHILL STREET · BIRMINGHAM · 4**

PHONE ASTON CROSS 3264 (7 LINES)

GRAMS VIKING, BIRMINGHAM

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*An Exhibition in itself....*



*one of* **WARD'S**  
**MACHINERY SHOWROOMS**  
**AT SHEFFIELD**

Others at: SILVERTOWN (LONDON) : GLASGOW : BRITON FERRY

**VISITORS ARE ALWAYS WELCOME AND  
REMEMBER — WARDS MIGHT HAVE IT!**

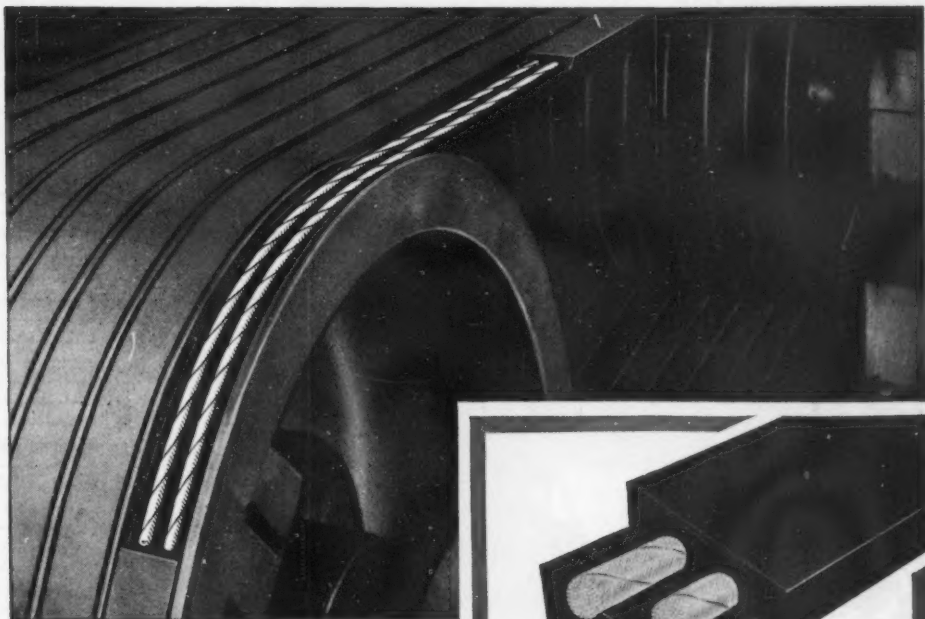
**THOS. W. WARD LTD**

**ALBION WORKS • SHEFFIELD**

'PHONE 26311 (22 lines). 'GRAMS 'FORWARD SHEFFIELD'  
LONDON OFFICE: BRETTENHAM HOUSE  
LANCASTER PL. STRAND W.C.2, 'PHONE TEM 1515

G.56

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## how a GROMMET V-BELT works

A BTR High Test Grommet V-belt drives heavier loads with a higher safety factor because it's stronger; transmits more power for electricity consumed because it's more flexible; lasts longer because it's more durable, size for size, than any other V-belt.

'Grommetise' your drives with BTR High Test Grommet V-belts, especially where conditions are punishing—the more difficult the drive the more outstanding you'll find BTR High Test Grommet V-belt performance.

- A grommet (a cord loop built by winding high-tensile rayon cord upon itself in an endless spiral) is essentially strong and flexible.
- Grommet spiral construction ensures that all the windings share the load and stresses equally.
- Two identical matched grommets symmetrically positioned in the belt share the load equally.
- The grommets are on the neutral axis of the belt and largely unaffected by flexing stresses as the belt travels round the pulleys.
- Grommet construction makes room for extra rubber to absorb shock loads and protect the grommets from unfavourable conditions.



**ENGINEERS  
IN RUBBER**

## BTR HIGH TEST GROMMET V-BELTS

Patented in Britain by BTR Patent No. 567406

**BTR Industries Ltd**

BRITISH THERMOPLASTICS & RUBBER MANUFACTURERS

Herga House, Vincent Square, London S.W.1 Telephone: VICtoria 3046

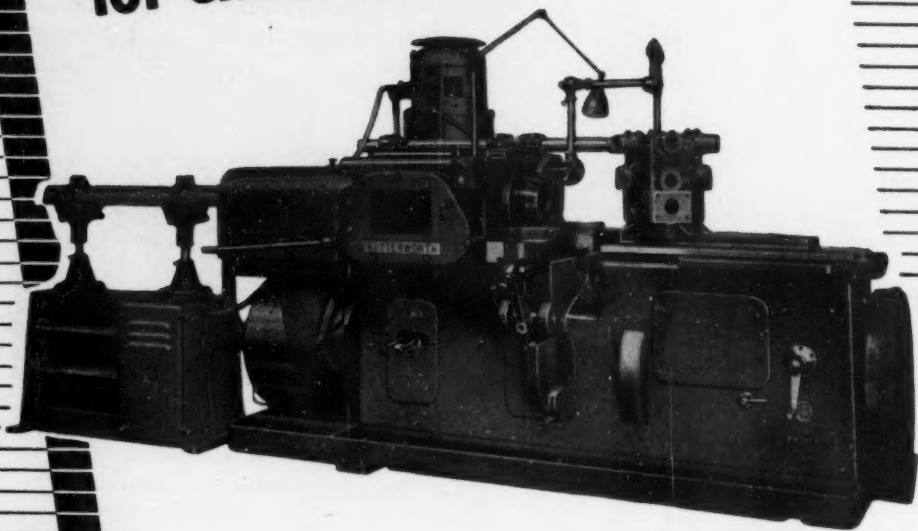
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# BUTTERWORTH

Reg. Trade Mark

## The AUTOMATICS for efficient performance



For bar work up to 3½ in. dia. these machines, designed and made in England, offer productive possibilities that will definitely offset rising production costs. Other sizes and models available include ¾" SD, 1"-1 1/8" SD, 1½" AG, 1 1/4", 2" and 2 1/2" H Type, 3" AG and 3 1/2" AG.

Send us your enquiries.

**MADE IN ENGLAND**

BUTTERWORTH BRITISH AUTOMATIC MACHINE TOOL CO. LTD., LINCOLN STREET, ROCHDALE

*When answering advertisements kindly mention MACHINERY.*



# SHAFT MOUNTED GEAR UNITS

*8 to 425 r.p.m., powers up to 120 h.p.*

## Features

Direct mounting on the driven shaft

No alignment problems

No slide rails

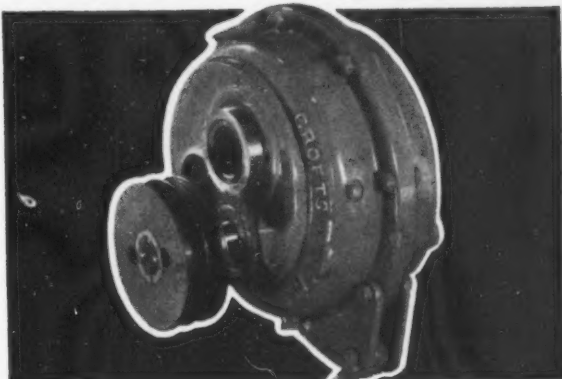
No flexible couplings

No baseplates

No supporting structure

## Performance

18 units provide speeds from 8 to 425 r.p.m. at powers from fractional to 120 h.p.



*The ideal reduction gear for all machinery drives...*

THE VARIOUS DRIVE ARRANGEMENTS ARE ILLUSTRATED OVERLEAF.

Complete details of speeds, powers and dimensions are published in our new Catalogue 157. Send us your name and address on this postcard to get your copy. There's no need for a stamp; just fill it in, tear it out and post it—now.

Postage will be paid by Licensee

No Postage Stamp necessary if posted in Great Britain or Northern Ireland

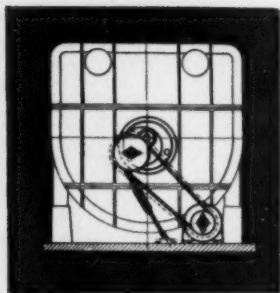
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Licence No. BD377

**CROFTS (ENGINEERS) LIMITED**  
**THORNBURY**  
**BRADFORD 3**  
**YORKSHIRE**



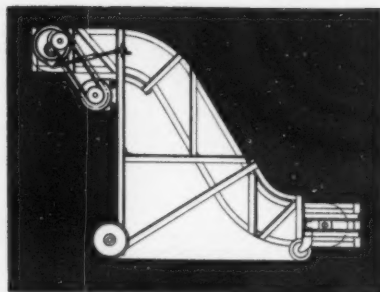
# SHAFT MOUNTED GEAR UNITS

*mount direct on the driven shaft*

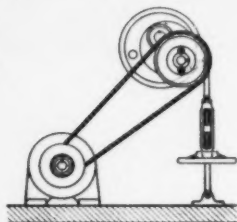
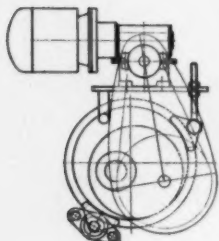


## STANDARD DRIVE

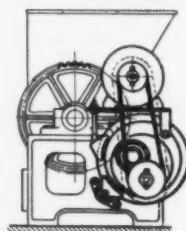
This is the most widely used of the various Shaft Mounted Gear Unit arrangements. Many production drives in many industries owe their smooth and profitable operation to this compact and efficient reduction gear. Further details of this and the drives shown below are contained in publication 157, a copy of which can be obtained by completing and posting the attached card.



## INFINITELY VARIABLE SPEED DRIVE

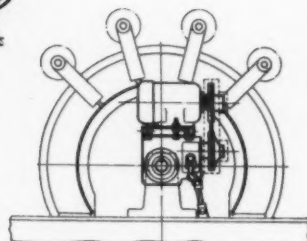


## PLATFORM MOUNTED WORM GEAR MOTOR DRIVE



## SHAFT MOUNTED WORM GEAR

## PLATFORM MOUNTED MOTOR DRIVE



## SHAFT MOUNTED GEAR UNITS

Please send without obligation.....copies of your publication 157 to:

Mr..... Chief Designer

Mr..... Plant Engineer

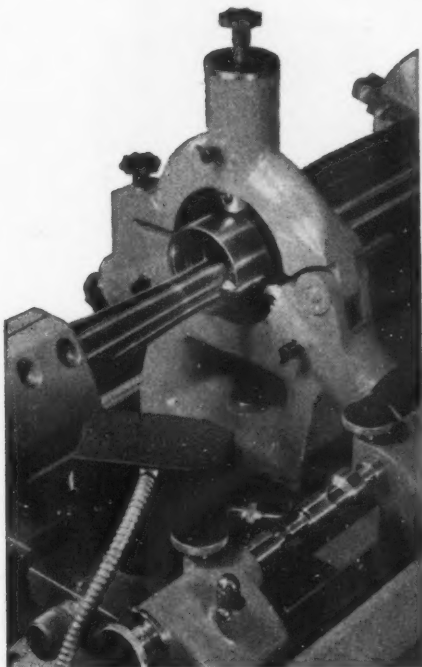
Mr.....

Company Address .....

.....

Crofts have  
branches at:  
BELFAST  
BIRMINGHAM  
BRISTOL  
CARDIFF  
DUBLIN  
GLASGOW  
IPSWICH  
LEEDS  
LIVERPOOL  
LONDON  
MANCHESTER  
NEWCASTLE  
NORTHAMPTON  
NOTTINGHAM  
STOKE  
SHEFFIELD

# **VDF UNICOP** the first name in electronic-hydraulic copying lathes



A comprehensive range of ten models, with capacities up to 27 inches diameter and 118 inches in length, covers all requirements. The ultra-sensitive copying device couples extreme accuracy with reliable trouble-free working. An advanced design of copy milling head is among the many items of additional equipment produced by the famous VDF Organisation.

A copy of this 80 page full colour book can be yours for the asking. It contains a wealth of information on the development of copying methods by the electronic-hydraulic process.

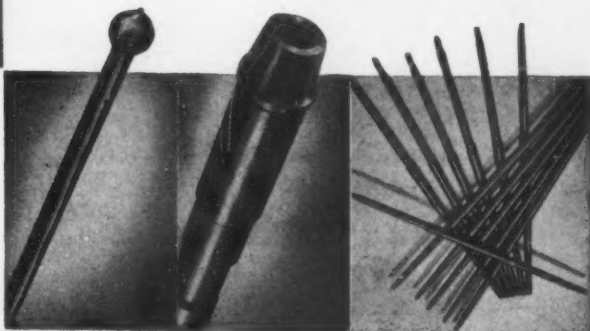


(ABOVE)  
Unicop Model V3 with boring bar  
clamp and boring bar for internal  
copying of a hollow spindle.

A batch of spindles copied on a  
Unicop. (RIGHT)

Hollow tapered spindle copied on a  
Unicop. (CENTRE)

Spherically ended control rod copied  
on a Unicop. (LEFT)



## **SYKES**

For full information please contact the Sole British Agents:

### **MACHINE TOOL CO. LTD**

**HYTHE WORKS • THE HYTHE • STAINES • MIDDX.**

Phone: STAINES 5076 (3 lines)

Grams: "SYTOOL, STAINES"

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# CEJ

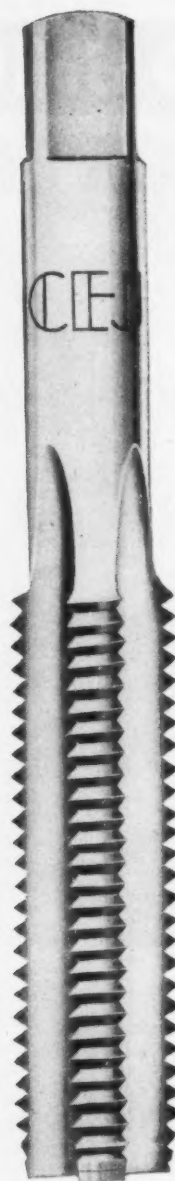
## THREADING TOOLS

### CEJ PRODUCTS

Ground Thread Taps  
Chaser Dies  
Screw Plug Gauges  
Screw Ring Gauges  
Circular Chasers and Holders  
Round Dies  
Thread Milling Hobs  
Thread Rolling Dies  
Plain Plug Gauges  
Mikrokators

Micro Snap Gauges  
Surface Finish Indicators  
Micrometers  
Bore Gauges  
Deltameters (Automatic Sizers)  
Drill Chucks  
Gauge Blocks  
Dynamometers

Extensometers  
Plain and Screw Snap Gauges  
Plain Ring Gauges  
Gronkvist Drill Chucks  
Dial Gauges  
Tapping Attachments  
Multiple Interference Microscopes  
Vernier Height Gauges




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**CEJ JOHANSSON LTD.**  
PRECISION TOOLS AND INSTRUMENTS

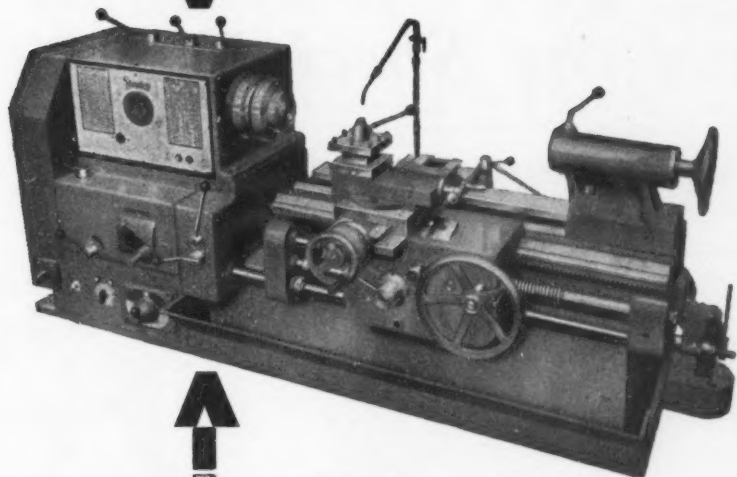
**A.I.D. AND A.P.I. APPROVED**

**SOUTHFIELDS ROAD, DUNSTABLE, BEDS • TEL: DUNSTABLE 422/3/4**

DHB/2359

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# WHAT'S NEW IN SLIDING BED LATHES?



For the answer to that, ask STANLEY. STANLEY have recently re-designed their 10½ inch Sliding Bed Lathe to incorporate several improvements.

The new Stanley is heavier—has greater horse-power—a wider bed—totally enclosed, built-in electrics. It can be supplied with a back turning rest to turn large diameters the full length of the open gap.

The Stanley Sliding Bed Lathe is really two lathes in one. It can be used as a standard centre lathe and also for large diameter, large width jobs which would otherwise call for a special machine.

Stanley lathes have been serving satisfied users all over the world for more than twenty years. The new model is designed and built to carry on this fine tradition.

All you want to know about the improved Stanley Sliding Bed Lathe is contained in a new catalogue—sent on request.

## HIGHLY SATISFIED USERS OF STANLEY LATHES

include: **Mullard Ltd.** **Bryant Symons & Co. Ltd.**  
**Laurence, Scott & Electromotors Ltd.** **Rosser & Russell Ltd.**  
**Prince of Wales Dry Dock Co. (Swansea) Ltd.** **Hobbs Transmission Ltd.**

# Stanley

**THE STANLEY MACHINE TOOL CO. LTD.**

**NEW BANK · HALIFAX · YORKSHIRE**

Telephone: Halifax 67233 Telegrams: "Makers" Halifax

# *for* ECONOMICAL MULTI-DRILLING

## *Consult the Specialists*

### **SLACK & PARR LTD**

We manufacture all types of multi-drilling equipment from a simple two-spindle adjustable model to a multi-head that will drill a large cylinder block in one operation. S.P.K. multi-heads are built-up from a range of standardised interchangeable spindle assemblies and housings, which have been developed as a result of many years' practical experience, resulting in the minimum cost and a proved performance.

*Should you desire any further information please fill in and post this coupon.*

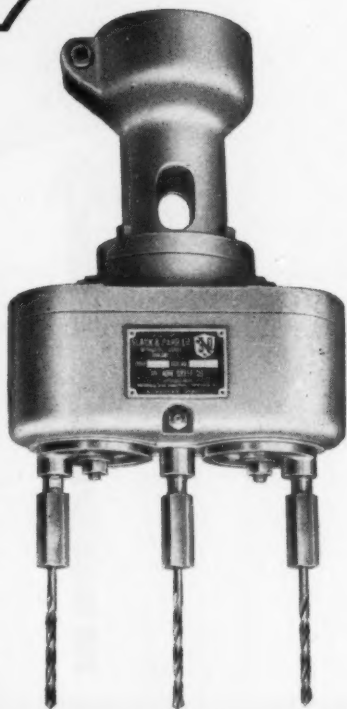
- |   |  |
|---|--|
| <input type="checkbox"/> Universally Adjustable Centre Drillheads DH101 | <input type="checkbox"/> Geared Fixed Centre Drillheads DH103      |
| <input type="checkbox"/> Gearless Fixed Centre Drillheads DH102         | <input type="checkbox"/> Geared Adjustable Centre Drillheads DH105 |
| <input type="checkbox"/> Multi-drilling Machines DH104/6                |  |

FIRM .....

Signature.....

Status.....

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**SLACK & PARR LIMITED · KEGWORTH Nr. DERBY · Tel.: Kegworth 306**

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# MARBAIX

FOR UNUSUAL MACHINES

**HERE IS  
YOUR  
OPPORTUNITY !**

**CUT** ——— **MAINTENANCE  
LABOUR COST**  
**IMPROVE** — **FINISH QUALITY**  
**REDUCE** — **IDLE TIME**

## \* **BARNESDRIL** **COOLANT SEPARATORS**

Coolant fed into a Barnesdril magnetic coolant separator continuously circulates around the drum of powerful permanent Alcomax magnets. Swarf, chips, and other ferrous particles are removed. Coolant is cleaned by the separator, thus preventing machine downtime and improving finishes.

### **A User Reports:**

"Our surface grinder (above) required six hours of cleaning and five gallons of coolant per week. With the Barnesdril magnetic separator installed, there has been no downtime in four months and coolant used has dropped to one gallon per week. We cut our grinding costs by £23 per week and paid for the installation in less than two months." Write for full details to Dept. M.19.

ORIGINATORS OF THE DRUM TYPE MAGNETIC AND COMBINATION SEPARATORS  
Made in Great Britain. Patents No. 603083, 731655 and 745604. Others pending.



### \* **BARNESDRIL**

No. 4 Magnetic Separator  
installed on a Blanchard  
No. 18 Surface Grinder

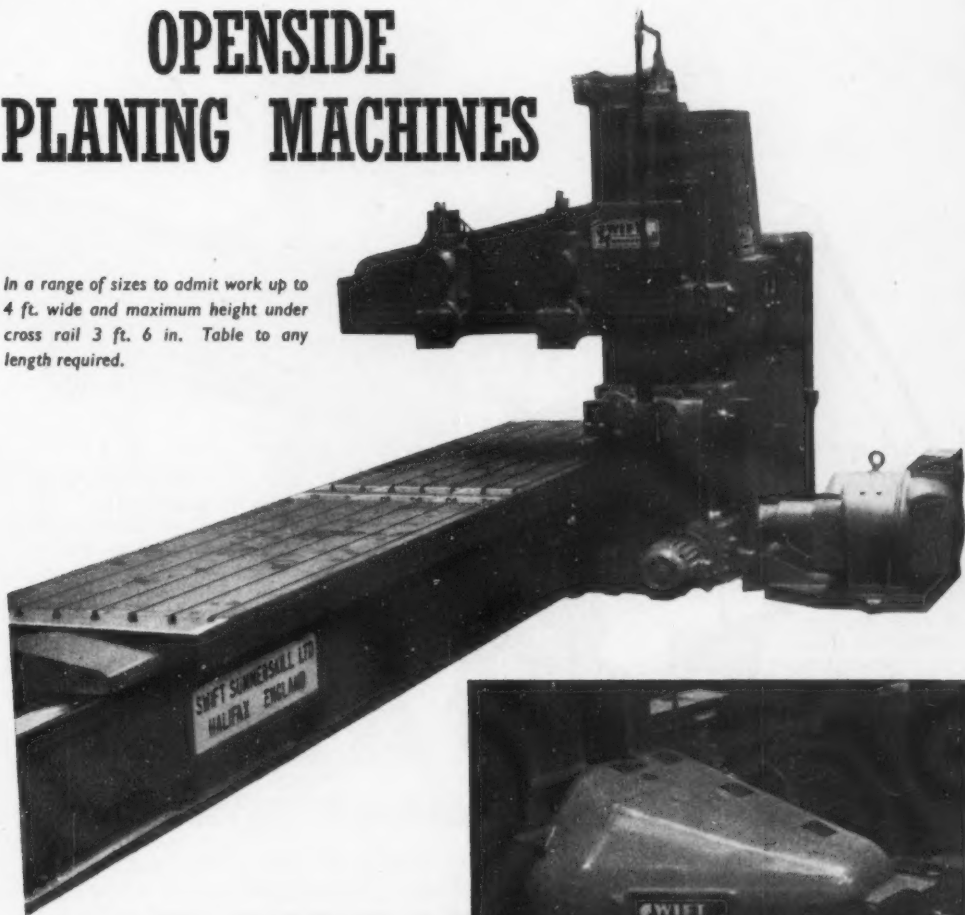
**GASTON E. MARBAIX LTD**

DEVONSHIRE HOUSE, VICARAGE CRESCENT,  
BATTERSEA, LONDON, S.W. 11  
PHONE BATTERSEA 8888 (8 lines)



# OPENSIDE PLANING MACHINES

*In a range of sizes to admit work up to 4 ft. wide and maximum height under cross rail 3 ft. 6 in. Table to any length required.*



The Swift-Summerskill all electric openside planer is of modern design that ensures the utmost rigidity and accuracy of alignment. Single helical gearing is employed for the table drive and a standard range of speeds from 25 to 200 ft. per min. is available. If required, alternative ranges down to 10-80 f.p.m. can be provided. The two smaller machines have feeds of 0.005 in. to 0.350 in. and the two larger planers feeds of 0.005 in. to 0.450 in. Write today for a catalogue describing these and other Swift-Summerskill Planing Machines.



This view of a Swift-Summerskill Openside Planer shows clearly the robust proportions of the buttress for the cross rail, which ensures rigidity.

**Write today for further details**

**SWIFT - SUMMERSKILL LIMITED**

CLAREMONT WORKS . HALIFAX . ENGLAND

Telephone : Halifax 3792 & 3793.



*When answering advertisements kindly mention MACHINERY.*



*a fine cut*



Of course, it's Savile Row for a fine cut. But in your line of country, Jessop-Saville tools give the best cut of all. Jessop-Saville "off the peg" high speed steel butt-welded tools are always available in 55 standard shapes and 15 shank sizes. The High Speed Steel Tips—electrically butt-welded to good quality carbon steel shanks—have exceptional wear and abrasion resisting qualities and consequently longer service between re-grinds. Please send for a copy of our Monthly Stock List.

# JESSOP-SAVILLE

**ARKWELD AND TRIUMPHWELD**  
high speed steel butt-welded tools

WM JESSOP & SONS LTD

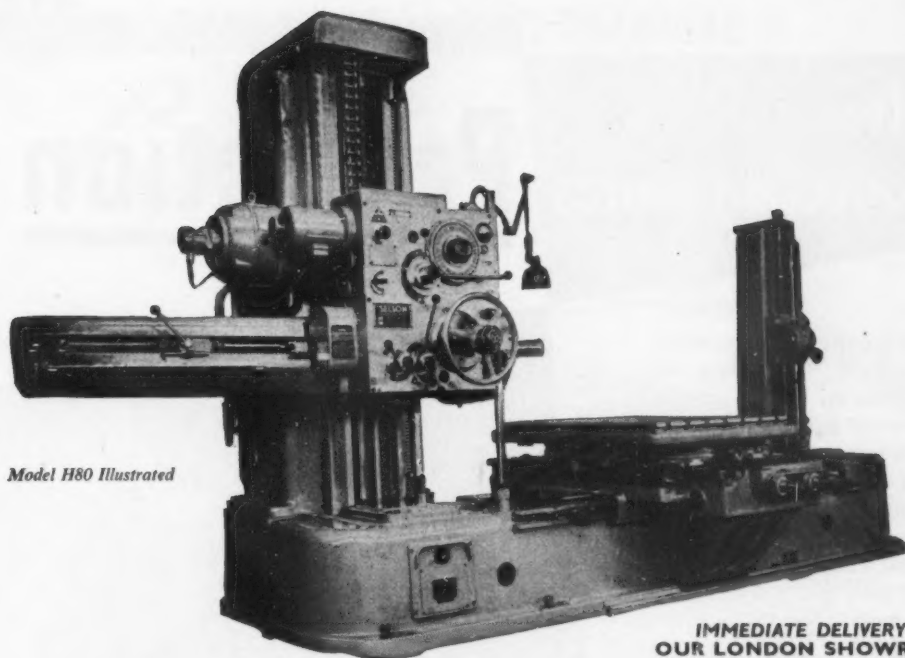
BRIGHTSIDE WORKS SHEFFIELD

ENQUIRIES TO: SMALL TOOL WORKS · PORTLAND STREET · SHEFFIELD 6



J J SAVILLE & CO LTD

TRIUMPH WORKS SHEFFIELD



Model H80 Illustrated

IMMEDIATE DELIVERY FROM  
OUR LONDON SHOWROOMS  
(Subject to prior sale)

# PLAUERT

## HORIZONTAL BORING and FACING MACHINES

Safety Clutch disengages automatically working feed or rapid traverse to prevent damage. Power feed to table (Longitudinal, Cross and Circular) • Push Buttons allow fine adjustment of Spindle or Faceplate when setting • Automatic cross feed to facing head • Designed and built for Precision Boring, Drilling, Milling, Threading, Reaming and Facing • Enduring accuracy • High productive ability • Wide speed and feed range • Ease of operation.

*Models H80 and H100 are arranged with electric preselection of spindle speeds and feeds.*

Sole Agents

### BRIEF SPECIFICATION

Model	H63	H80	H100
Diameter of Spindle ... ..	24"	31"	38"
Max. diameter for facing ... ..	22"	28"	35"
Working surface of table (width x length)...	28" x 35½"	35½" x 44½"	44½" x 49½"
Number of spindle speeds ... ..	16	18	27
Range of spindle speeds: r.p.m. ... ..	8—1400	5.6—1000	2.8—710



## The Selson Machine Tool Co. Ltd

41-45 MINERVA ROAD, NORTH ACTON, LONDON, N.W.10

Telephone: Elgar 4000 (10 lines) Telegrams: Selsomachi, London, N.W.10

600  
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**After  
production comes**

# **Protection**

With the present necessity to reduce the costs of production, it is more than ever important that any wastage of machined parts should be kept to a minimum. All ferrous parts should be protected against rust between processes, before and after assembly, in storage or transit.

There is sure to be a grade in the RODOL range of rust preventives that will give the right degree of protection for your particular usage.

Literature is available which describes the properties of the various RODOL grades and assists in the selection of the correct grade for any duty.

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**RUST PREVENTIVES**

to give positive protection

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**HYDRAULIC and MECHANICAL**

# Guillotine Shears

WITH HYDRAULIC HOLD-DOWN

**W  
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FOR PLATES  
 $\frac{1}{8}'' \times 23'-0''$

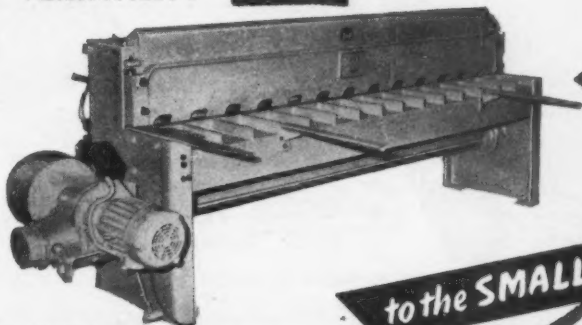


**ACCURACY**

*from the LARGEST*

**VERSATILITY**

FOR PLATES  
 $\frac{1}{16}'' \times 6'-0''$



*to the SMALLEST*

**DESIGN SUPERIORITY**

MANY EXCLUSIVE  
ACCESSORIES  
FOR UNIVERSAL  
USE



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Telephone: ABBEY 5338 Telegrams: POWAFORGE, SOWEST, LONDON Cables: POWAFORGE, LONDON

Rainbow 1187

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*The most advanced Reamer in use today!*

CHEAPER THAN FIXED REAMERS IN THE LONG RUN • ALREADY COPIED BY OUR COMPETITORS

*Adjustable continuously and smoothly to a larger or smaller size  
within a range of .007in., sizes from ½in. dia., to 2in. dia.*



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BIRMINGHAM BRANCH OFFICE: 61-63 • HAGLEY ROAD • BIRMINGHAM, 16

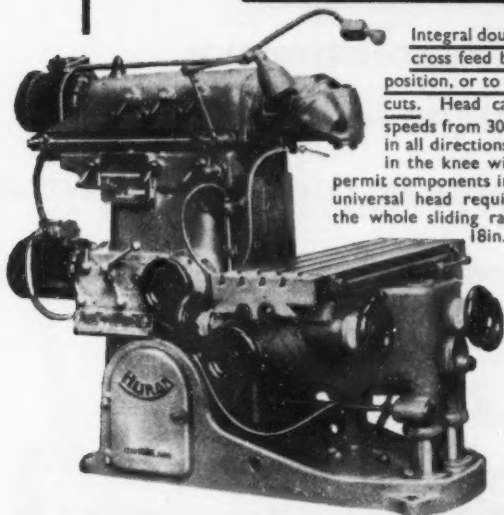
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SLIDING RAM  
GIVES 27½ in.  
AUTO CROSS  
FEED

## HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

### HURON SUPER UNIVERSAL MILLERS



Integral double swivelling universal head provided with 27½ in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m. 27 feeds from 1/16 in. to 30 in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14 in. to enter work pieces and the whole sliding ram with its 27½ in. automatic cross movement needs only 18 in. clearance.

Type	Table	Automatic Feeds		
		Long	Cross	Vert.
KU4	56½ in. x 15½ in.	43½ in.	27½ in.	19½ in.
KU5	64½ in. x 15½ in.	51½ in.	27½ in.	19½ in.
KU6	78½ in. x 16½ in.	59 in.	27½ in.	19½ in.
L7	157 in. x 39 in.	118 in.	27½ in.	39½ in.

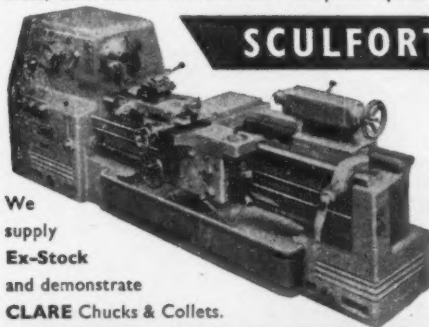
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting.

The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table, and the sliding ram moves vertically and horizontally.

## DUFOUR UNIVERSAL MILLERS

Table surface 43½ in. by 9½ in. or 47½ in. by 10½ in. Auto long. feed, 26½ in. or 30½ in. Auto vert. feed, 15½ in. or 18½ in. Auto cross feed 9½. Rapid traverse in all directions. No. 40 International taper for main spindle, universal head, and rotary table. Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Spindle speeds 21 to 1,600 r.p.m. Twin overarms. Separate motor for rapid traverses.

Also table 63 in. by 15 in., with auto feeds: 40 in. long., 21 in. vert., 14 in. cross; 25 in. auto-univ. head feed. 36 spindle speeds 6 to 1,500 r.p.m.



We supply  
Ex-Stock  
and demonstrate  
CLARE Chucks & Collets.

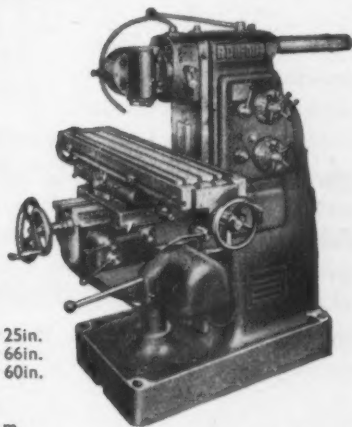
## SCULFORT LATHES

Swing over bed 20, 22 or 25 in.  
and 28, 32 or 66 in.  
and 40, 47 or 60 in.

Speed ranges: 6-2,000;  
12-1,600;  
or 3½-325 r.p.m.

18-45 h.p. motor drives for max. output. Totally enclosed gear box provides 90 different pitches. Flame hardened bed. Large spindle bore. All head stock gears hardened and ground. Built-in coarse screw cutting device.

Other products: Copying lathes, Locomotive and Carriage Wheel Turning Lathes, Centreless Bar Turning Machines, Facing Lathes and Special Purpose Centre Lathes.



# Rudolph Carne & Co. Ltd.

SWAN WORKS, FISHERS LANE,  
CHISWICK, LONDON, W.4.

Telephone: CHISWICK 0514 & 6585. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON.

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## Today's revolutionary technique—

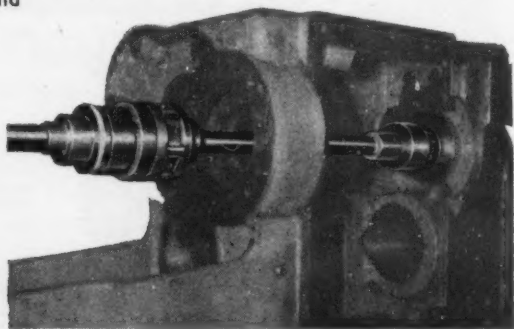
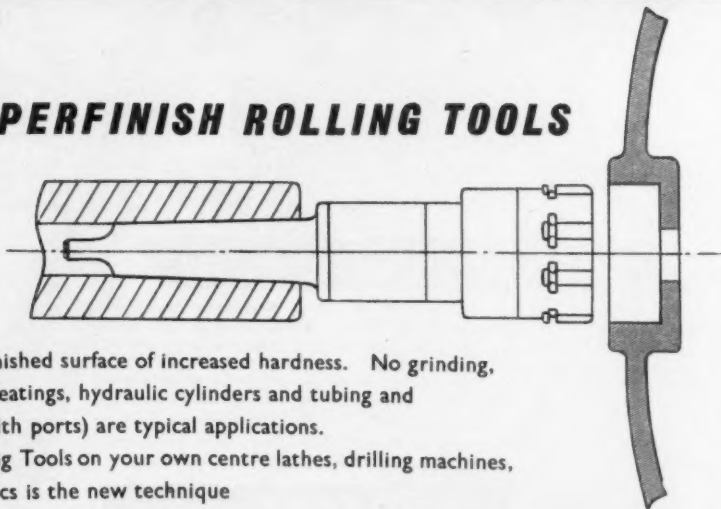
**SUPERFINISH BY COLDFORMING WITH**

### **"RODO" SUPERFINISH ROLLING TOOLS**

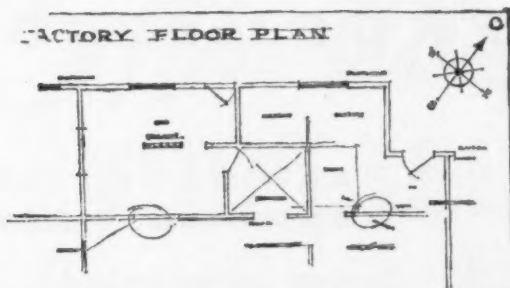
With 'Rodo' Rolling Tools  
you can go straight from a  
pre-machined bore to a close

tolerance bore with a superfinished surface of increased hardness. No grinding,  
lapping or honing. Ballrace seatings, hydraulic cylinders and tubing and  
bores in valve bodies (even with ports) are typical applications.

Coldforming by 'Rodo' Rolling Tools on your own centre lathes, drilling machines,  
boring machines and automatics is the new technique  
for finishing blind and through holes of any size and  
length in almost any material. May we give  
you fuller information?

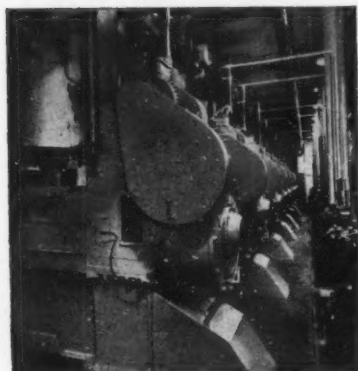


**MACHINE SHOP EQUIPMENT LTD., SPENSER STREET LONDON. S.W.1 Telephone VICToria 6086.**



## I'm a spaceman myself!

but don't get me wrong. I won't be on the first moon rocket. I'm putting my factory space which cost good money to its proper use. In other words, I'm using it to house machinery and not throwing it away on big space-wasting drives. If you think three-dimensionally, like me, you'll use chain drives, and get another machine or two on that floor.



Photograph by kind permission of  
Rose, Downs & Thompson Ltd., Hull.

# RENOLD chain drives conquer space problems in almost all applications

*This oil expeller installation for the  
treatment of oil bearing seeds and nuts is  
equipped with Renold Stock Chain Drives.*



save space



save power



increase production



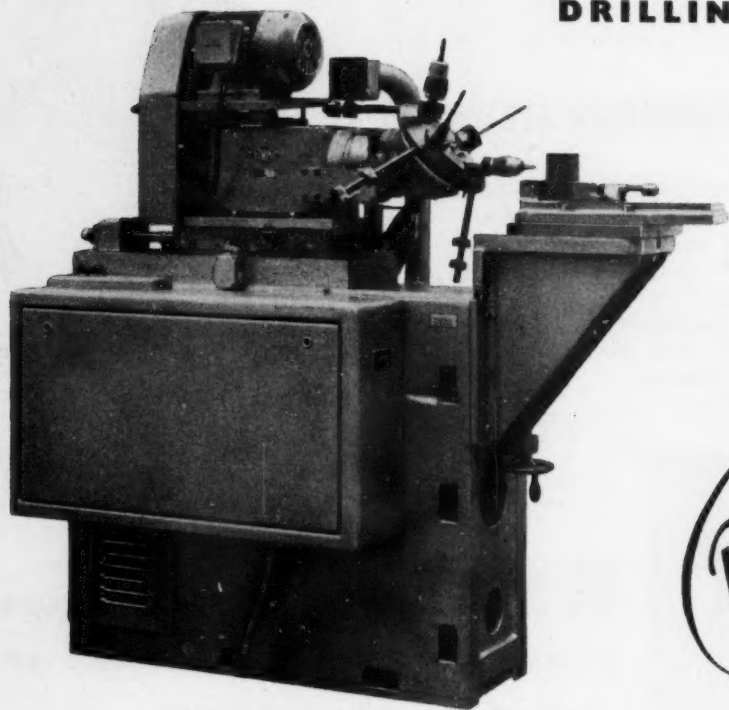
— the **FIRST** name in precision chain

RENOLD CHAINS LIMITED • MANCHESTER

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# AUTOMATION FOR YOUR BATCH PRODUCTION ARBOMAT

## AUTOMATIC TURRET DRILLING MACHINE



*Prompt  
delivery*

The ARBOMAT is a fully automatic turret machine, with 2 to 6 stations of  $\frac{3}{8}$  in. capacity, or 2 to 4 stations with 1 in. capacity, in steel. It drills, reams, counter-sinks, taps or screws at different tool speeds, pre-selected for each station, in an automatic cycle.

It is a matter of minutes only to change the individual speed, rapid traverse and feed stroke for any station, or to vary the rate of feed or the number of stations, for another job. The ARBOMAT is, therefore, as economical for medium or even short runs as for continuous production.

**THOKA**

**THOKA MACHINERY SUPPLIES LTD.**  
2 DRAPERS GARDENS · LONDON · E.C.2  
Phone: NATIONAL 7391. Cables: THOKANE, London.

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# 3 New Attachments

make the **THIEL 158**

your Toolroom's most  
**VERSATILE Machine**

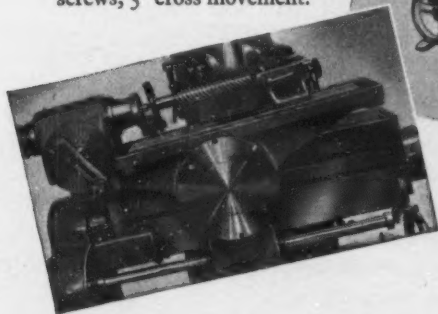


## 1 New Jig Boring Head

Precision head, running in extra wide ways, equipped with three power feeds, 7" power operated slide movement complete with dial gauge and slip gauge holder, 12 spindle speeds available through machine, 360° swivel.

## 2 New Table

Universal swivelling and tilting compound table with large clamping area. Heavy rigid construction and fitted with hardened and ground lead screws, 5" cross movement.



*All these new attachments can be fitted to any one of the hundreds of Thiel 158 Machines already in the field.*

## 3 New Spiral Milling Attachment

Ideal for manufacturing cylindrical or conical reamers, milling cutters as well as worms and a host of other parts.

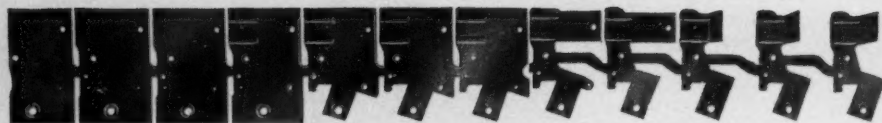
**ROCKWELL**  
MACHINE TOOL CO. LTD.

*For further particulars write or telephone TODAY*

WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

*When answering advertisements kindly mention MACHINERY.*

**BRITISH-BUILT****MACHINES****offer new opportunities****to produce *Intricate Stampings*****automatically and cheaply!**

Most stampings, from simple brackets to intricate parts, which previously required operations on several presses, each with its own operator, can now be produced automatically with great accuracy, at high speed, on *ONE* British-Built U.S. Multi-Slide Machine. If you use a number of presses to produce stampings or if you use progression tools for parts made from coiled material up to 3½" wide, here are reasons why we are almost certain to be able to send you a most interesting proposal.

1. The extreme accuracy of the feed employed and the fact that bending tools can be adjusted independently

makes it much easier to obtain a high quality part.  
2. Sturdy construction of machine and its attachments as well as instantaneous braking through monitoring devices, increase tool life and reduce risk of tool breakages.

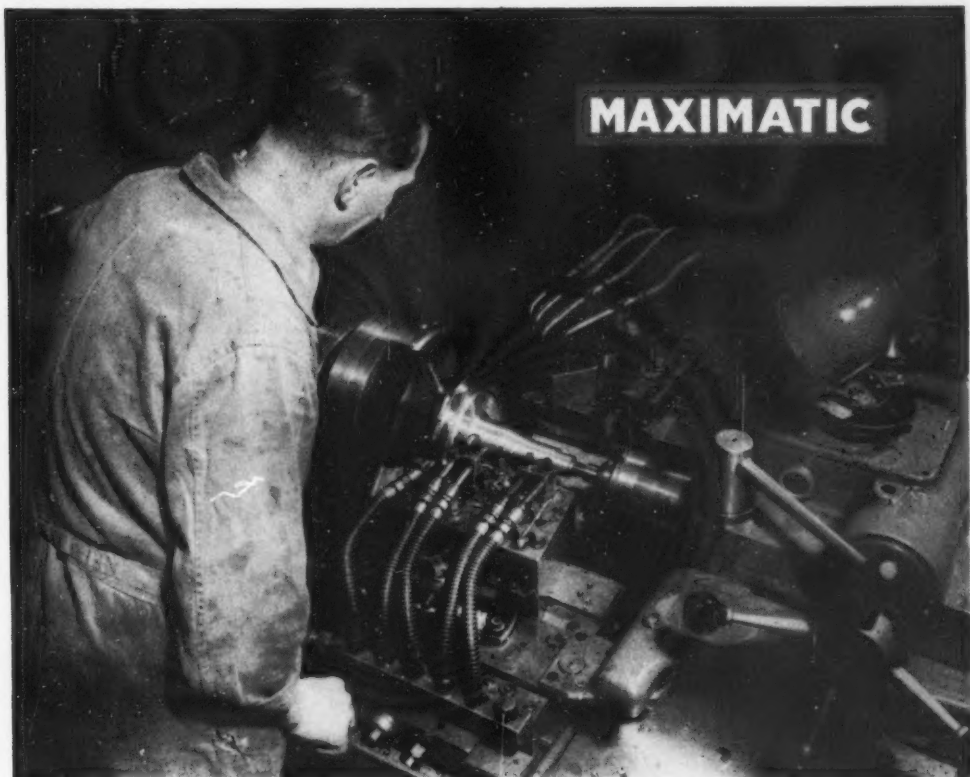
3. Material is saved because no extra material width is usually required either for piloting or side-cropping. The developed blank is in continuous strip, *not* held in a material webbing which becomes scrap. Material savings up to 25 per cent. are possible. In some cases production can be doubled by making two components from one strip.

**ROCKWELL**  
MACHINE TOOL CO. LTD.

*For further particulars write or telephone TODAY*

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## ***Automatic multi-tool lathe for high-output production***

This illustration shows the Maximatic Automatic Multi-Tool Lathe turning axle swivel forgings, requiring several diameters, and facing.

Once set, a single lever operates the machine for each cycle, and high-output, accurate production is only a matter of load and unload. Adaptability in the setting of the cross-slides to a large extent governs the usefulness of a machine of this type and the Maximatic scores heavily in this respect. Each cross-slide is independently operated by flat former plates,

so that adjustment to new jobs can be made easily, and by suitable setting of cams in the feed box a variety of movements can be obtained.

Maximatics are available in a range for work up to 11in. centre height by 78in. between centres. Write today for full details.

**WILLIAM ASQUITH LTD.**  
HALIFAX · ENGLAND

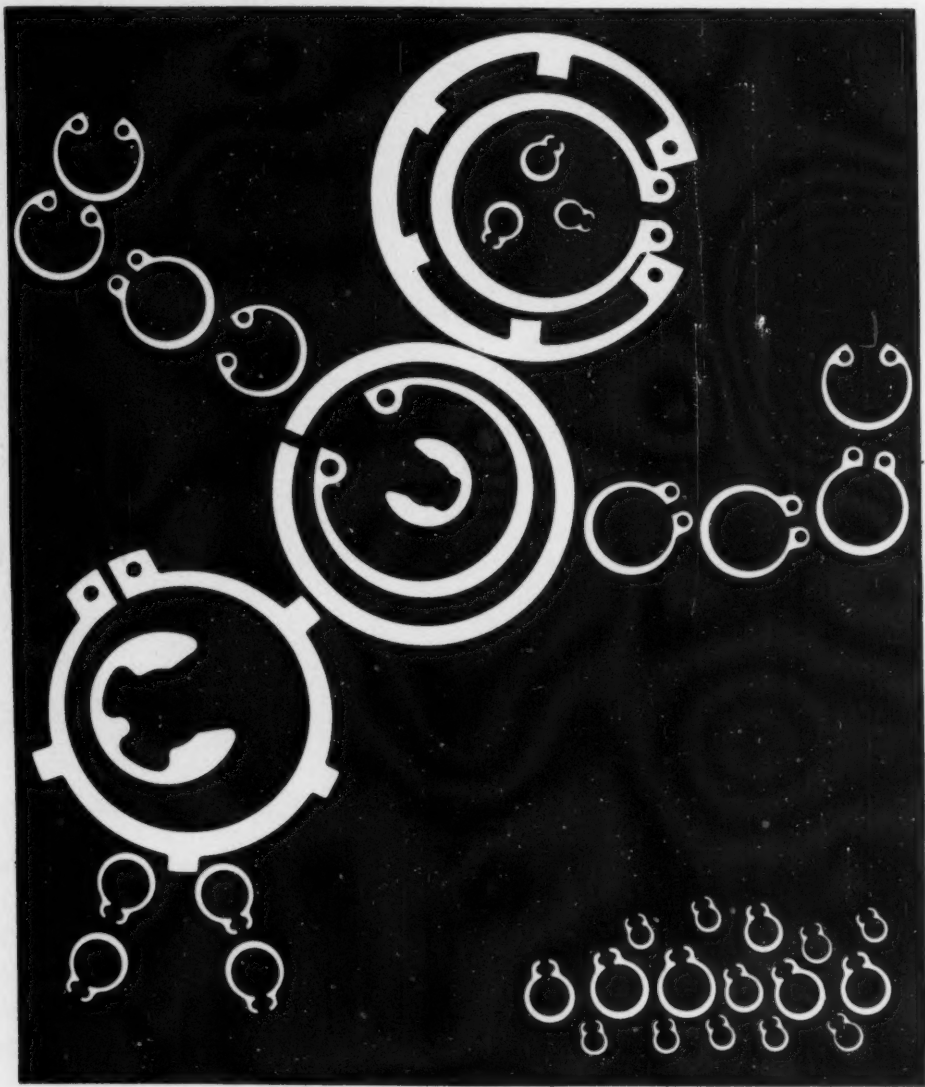
Sales & Service for . . .

**DRUMMOND-ASQUITH**

. . . the British Isles

**DRUMMOND-ASQUITH (SALES) LTD., KING EDWARD HOUSE, NEW ST., BIRMINGHAM**

\*Phone: Midland 3431 (7 lines) \*Grams: Maxishape, B'ham. Also at LONDON: Phone: Trafalgar 7224 (5 lines) and GLASGOW: \*Phone: Central 0922



**“ SEEGER CIRCLIPS . . . easy to fit and 360° safe! ”**

**Automotive Engineering Limited**

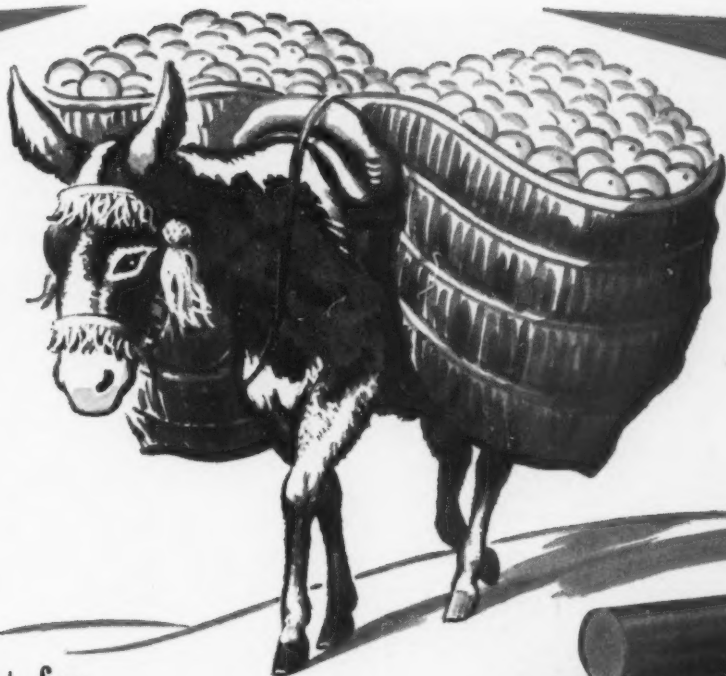


One of the Sheepbridge Engineering Group.

The Green, Twickenham, Middlesex.

Telephone: Popesgrove 2206/9. Telegrams: Motif, Twickenham.

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-but for  
fractional horse-power  
in industry...



whatever the load, wherever the duty, 'ENGLISH ELECTRIC' f.h.p. motors will take it in their stride and deal with it quickly, efficiently and economically. These sturdy motors are built to take on the 'donkey-work'. There is the right f.h.p. motor for your job in the 'ENGLISH ELECTRIC' range from 1/20th h.p. upwards. *Details of the full range will be sent on request.*

# 'ENGLISH ELECTRIC'

## f.h.p. motors

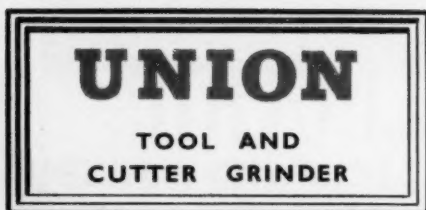
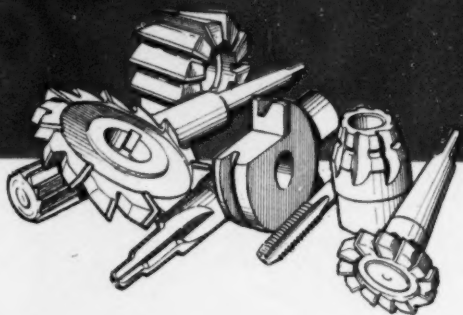
THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2  
F.H.P. Motors Department, Bradford

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FHP 38F7

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**grinding  
costs...**

**AND TOOL COSTS**



**PAYS OFF IN TOOL SAVINGS**

Prolonged tool and cutter life,  
and better quality finishing  
are yours with the Union Tool  
and Cutter Grinder.

**£157·15**

**COMPLETE WITH  
CABINET BASE**

*Send for fully detailed leaflet TODAY.*

**T. S. HARRISON & SONS LIMITED HECKMONDWIKE YORKSHIRE**

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# Introducing the SYNTRON EB.00



The EB.00 is the newest and smallest feeder in the Syntron Bowl Feeder range, being only 6 in. in diameter and 6½ in. high. It is supplied with a quick release bowl, clockwise or anti-clockwise discharge and easy-to-operate controller. This compact unit and the other Syntron Bowl Feeders in the range provide the orientated feeding of small parts one at a time.

## SYNTRON *KEEPS THINGS MOVING*

FULL DETAILS AVAILABLE ON REQUEST

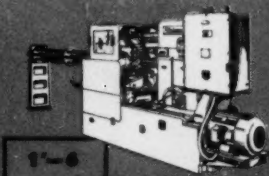
RILEY (IC) PRODUCTS LIMITED · ONE OF THE INTERNATIONAL COMBUSTION GROUP OF COMPANIES  
NINETEEN WOBURN PLACE, LONDON, W.C.1. TELEPHONE: TERMINUS 2622

72A 980

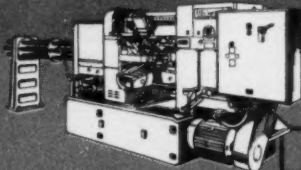
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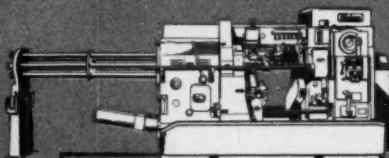
# The



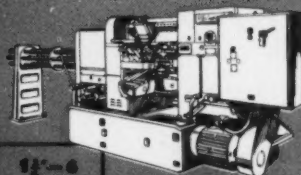
1'-6



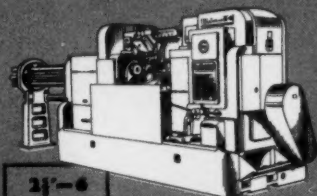
1 1/2'-6



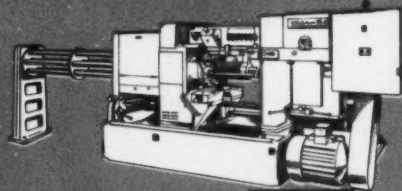
1 1/2'-8



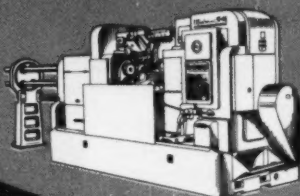
1 3/4'-6



2 1/2'-6



2 1/2'-8



3 1/2'-4

## BAR MACHINES

Range of machine sizes

	1'-6	1 1/2'-6	1 1/2'-8	1 3/4'-5	2 1/2'-6	2 1/2'-8	3 1/2'-4
Cycle times—secs. ...	2-4-129	3-9-337	4-3-337	4-3-300	7-602	7-1-922	8-3-924
Spindle speeds—r.p.m.	247-330	132-2,000	132-1,667	126-1,368	111-1,302	70-1,004	60-786

## CHUCKING MACHINES

	5 1/2'-6	6'-5	6 1/2'-6	7 1/2'-6	9'-4
Cycle times—secs. ...	4-3-337	4-3-300	7-859	7-1-922	13-8-1,315
Spindle speeds—r.p.m.	132-1,667	104-1,129	78-1,302	77-1,004	43-554

*... and of course — no cams to change!*

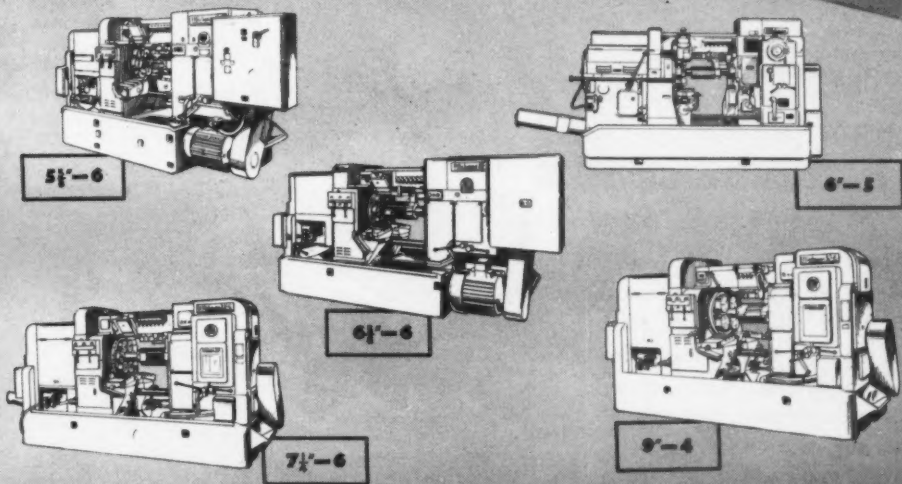
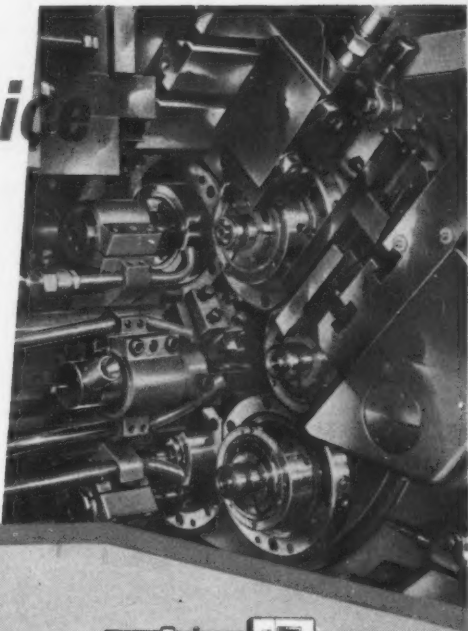
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# Automatic choice

for continuous or  
batch production

Repetition production economics frequently hinge upon the selection of a machine size and type just right for the job.

The Wickman range of automatics incorporating bar machines up to 3½" capacity and chucking machines up to 9" capacity make the selection of the right machine comparatively easy.



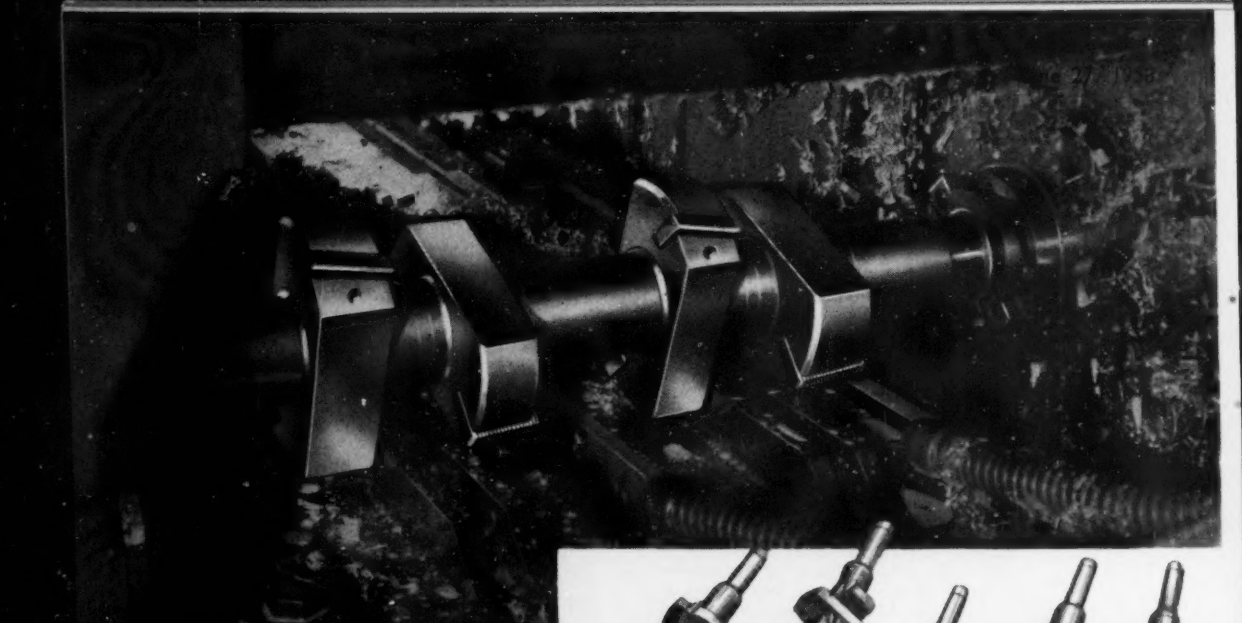
WICKMAN  LIMITED

MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

Telephone: 416, 417, 418, 419

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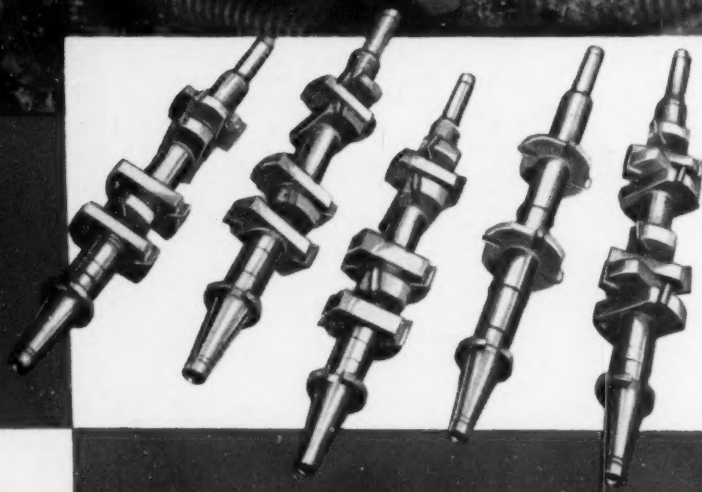
510WH



*Milling aircraft  
spar booms at  
5,300 ft per min*

GALTONA O.K. special two-bladed carbide tipped cutters are illustrated machining light alloy aircraft main spars from the solid at a cutting speed of 5,300 ft. per minute. Four cutters operate simultaneously and metal removed by each cutter is  $1\frac{3}{4}$  in. by  $1\frac{1}{4}$  in. at a feed of 12 in. per minute.

*GALTONA O.K. standard and special cutters are available in all types for machining a wide variety of materials, and our Tool Engineers will always be pleased to make recommendations on request for cutters to suit individual needs, without obligation.*



**Galtona**  
O-K

**SERRATED BLADE CUTTERS**

*Richard Lloyd Limited*

GALTON HOUSE, ELMFIELD AVENUE, TYBURN, BIRMINGHAM, 24

Telephone: Ashfield 1801. Telegrams "Cogs, Birmingham"

NORTHERN AREA OFFICE:

A. V. Green, Britannia House, Wellington Street, Leeds, 1. Phone: Leeds 21212.

LONDON AREA OFFICE:

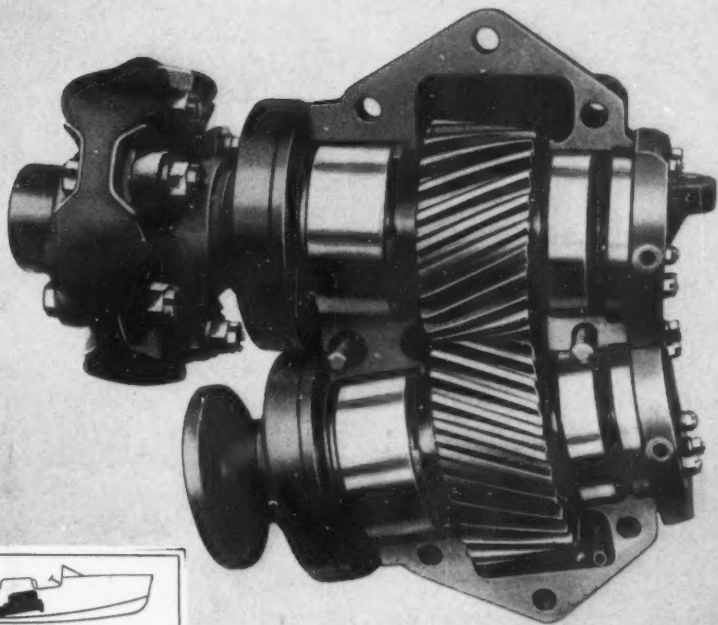
A. J. Percy, 240, Romford Road, Forest Gate, London, E.7. Phone: MARYland 2564.

NORTHERN IRELAND:

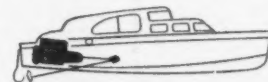
Garage & Engineering Supplies Ltd., 78 Great Victoria Street, Belfast.

SCOTLAND:

Stuart & Houston, 5 York Street, Glasgow, C.2.



In a conventional inboard installation (above), the engine must be mounted in the centre of the boat with a direct drive to the propeller. Mounting the engine in the rear of the boat (below) greatly increases cabin space and hold capacity. Gleason engineers assisted the Marine Engine Manufacturers in the development of the V-drive.



Take, for example, this marine V-drive. The use of spiral bevel gears permitted a design which released more usable space in the boat, improved balance, and simplified installation.

This is just one instance of the added flexibility of product design made possible with angular power transmission.

HEAD OFFICE:  
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BRANCHES:  
BIRMINGHAM · GLASGOW  
LEEDS · MANCHESTER

## *Angular power transmission can improve your product, too*

Faster production and lower costs will also result from using this type of transmission.

If you have a design application for bevel or hypoid gears, our Gear Development Department, with its well equipped shops and trained personnel, is ready to help you realise every advantage

possible. Design and production recommendations for your angular drive are offered without obligation.

If you would like to discuss this, or any other bevel gear application with a Gleason Engineer, please contact us.

# GLEASON WORKS

*Builders of bevel gear machinery for over 90 years*

*Sole Agents in United Kingdom*

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OTTERSPOOL WAY · WATFORD BY-PASS · HERTS.  
TELEPHONE: WATFORD 6681

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## METAL-EDGE FILTERS

These filters incorporate the Purolator precision-wound metal element which presents a series of knife-edged orifices to the incoming fluid. This ensures that all arrested contaminant remains on the outer surface of the element so that it can easily be cleaned off. The type shown here is fitted with a mechanical cleaning device which will remove dirt from the element whilst it is actually working.

A range of sizes from  $\frac{3}{8}$ " to 2" B.S.P. is available and element spacings from .002" to .020" can be provided.

HAND WHEEL  
Rotate to clean

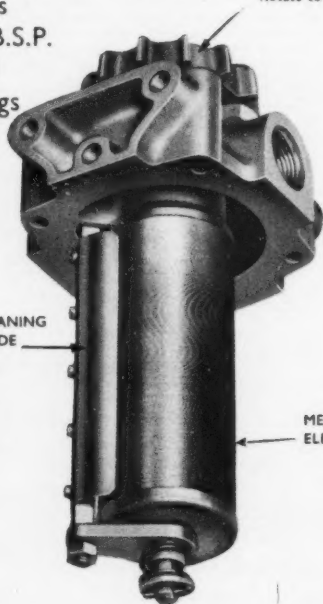
CLEANING  
BLADE

METAL  
ELEMENT

# PUROLATOR

Regd. Trade Mark: Purolator

AUTOMOTIVE PRODUCTS COMPANY LIMITED  
LEAMINGTON SPA, WARWICKSHIRE, ENGLAND



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**POLISHING LATHES  
AND  
POLISHING SHOP  
REQUIREMENTS**

PRODUCT OF THE *Morrisflex* GROUP OF COMPANIES

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# *interchangeability . . .*

of gauging heads obtained by simple quick-release gauge plug adaptor . . .



AIR PLUG GAUGES  
for  
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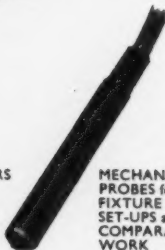


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for  
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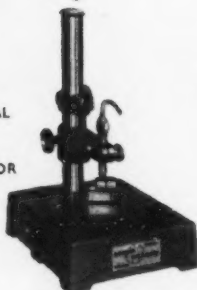


AIR RINGS  
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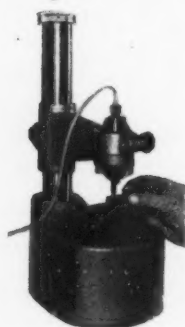
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M.I. AIR COMPARATOR  
for  
REFERENCE WORK and  
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THE MERCER AIR GAUGE SYSTEM IS  
UNCOMMONLY VERSATILE IN APPLICATION  
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THOMAS MERCER (AIR-GAUGES) LTD.

ST. ALBANS

HERTS

ENGLAND

ST. ALBANS 55313

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# 4 outstanding features of the **Lamberton** high speed vertical forging press

## **Caliper type brake**

Our own design giving excellent performance under severest conditions.

## **Top and bottom ejectors**

air operated, adjustable to suit all requirements.

## **Operation of air ejectors**

can be limited to every second or third stroke as required.

## **Calibrated table adjustment**

ensures accurate die setting.

The Lamberton Press produces accurate forgings at high speed under rigorous production conditions, and requires minimum maintenance for safe, reliable operation.



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## CONVEYOR PROBLEMS?

**Then get Goodyear,  
the world's most economical,  
most widely used belts**

Whatever materials you convey there is a Goodyear Conveyor Belt that is made to do the job—at the lowest cost per ton. These are the features essential for dependable, long life belt service—the features you get when you buy Goodyear.

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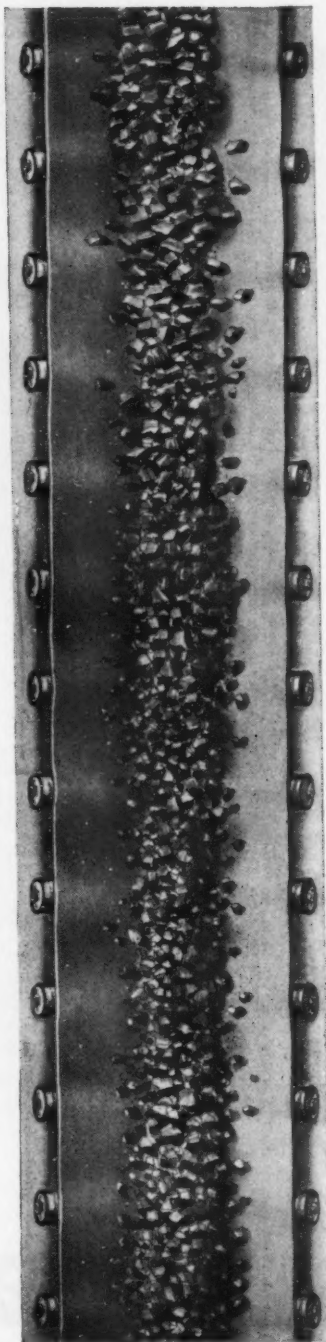
Remember that Goodyear technicians are always available to ensure that you get the right belt for the job and will advise on installation and maintenance.

Write now for further information to the Goodyear Tyre & Rubber Company (G.B.) Ltd., Industrial Rubber Division, Wolverhampton.

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**INDUSTRIAL RUBBER PRODUCTS**

CONVEYOR BELTING · TRANSMISSION BELTING · V-BELTS · FENDERS · HOSE



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## Same again please

An operator using one Norton B11 Wheel for a high speed fettling job, and then another, is more than pleased when he finds the second one is virtually the same again. He finds there is the same consistent behaviour throughout the life of both wheels, the same faster cutting rate and that improved "built in" balance which minimises vibration and wheel bounce, reduces operator fatigue, increases wheel life and lowers grinding costs. This superior performance arises from the B11 Bond which Norton have developed and from the advanced manufacturing technique now being employed. From the operator's point of view Norton B11 Wheels make his job easier and give him an opportunity to achieve even greater output and better workmanship; from the point of view of management they enable costs to be determined with much greater accuracy and promote lower grinding costs.

A simple change to Norton B11 Wheels for high speed fettling bring all these gains—see your Norton or Alfred Herbert Representative or write to us at Welwyn Garden City.

**NORTON B11 WHEELS FOR HIGH SPEED FETTLING!**

**NORTON GRINDING WHEEL CO. LTD.**

WELWYN GARDEN CITY, HERTS.

Telephone: WELWYN GARDEN 4501 (10 lines)

**NORTON ABRASIVES**

Enquiries also to: **ALFRED HERBERT LTD., COVENTRY**

NORTON and BEHR-MANNING factories also in Argentina, Australia, Brazil, Canada, France, Germany, Italy, Northern Ireland, South Africa, and U.S.A.



# DENHAM

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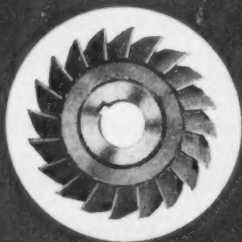
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STAMFORD.**

**16ins. to 40ins. SWING  
HEAVY DUTY LATHES from**

**DENHAM'S ENGINEERING CO., LTD., HALIFAX, ENG.**

Why not make your cutting tools from

**K E LOCK HIGH SPEED STEELS**



All these tools have been made by various well-known manufacturers from K E LOCK High Speed Steels—materials used by them over a considerable period and found to be completely satisfactory.

We can offer all the popular qualities, including

**K E LOCK 1021** 18% Cobalt, Taperless Vanadium Molybdenum High Speed Steel

**K E LOCK 217** 18% Tungsten Vanadium High Speed Steel (EMH)

**K E LOCK 795** 24% Taperless Vanadium High Speed Steel

**K E LOCK A 157** 5% Molybdenum, Tungsten Vanadium High Speed Steel (S/S/2)

Available in the form of forgings, bars, black rolled bars, cold drawn and centrifugal ground (1°–2° clearance only) angles.

Our local Technical Representatives would be pleased to call on you at any time—just phone:  
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**KAYSER ELLISON & CO. LTD**

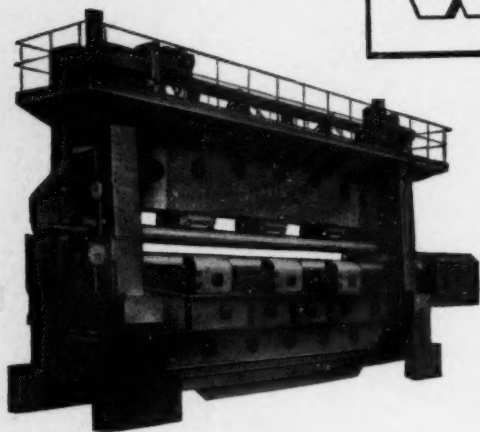
ESTABLISHED 1929  
CARBIDE STEEL WORKS - SHEFFIELD

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# modern shipbuilding equipment by

# WAGNER

OF DORTMUND



## WAGNER SHIP & MARINE ENGINE BUILDING MACHINES

**SHIP PLATE BENDING MACHINES**  
with or without pre-bending.

**HYDRAULIC BENDING MACHINES**  
from 160 tons.

**THREE-ROLL BENDING MACHINES**  
with or without pre-bending.

**FOUR-ROLL BENDING MACHINES**  
for plates from  $\frac{3}{8}$  in. thick.

**SHIP RIB BENDING MACHINES**  
for sections up to 16 in. deep.

**ROLLER SECTION BENDING MACHINES**  
with or without pre-bending.

Please let us demonstrate to you.

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ASSOCIATES LIMITED

**PLATE STRAIGHTENING MACHINES**  
for plates from  $\frac{3}{8}$  in. thick.

**DOUBLE STANDARD PLATE SHEARS**  
for plates from  $\frac{3}{8}$  in. thick.

**CIRCULAR CUTTER SHEARS**  
for plates from  $\frac{3}{8}$  in. thick.

**CIRCULAR CUTTER TRIMMING SHEARS**  
for trimming both sides and slitting plates from  $\frac{3}{8}$  in. thick.

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also with planing attachment for plates  $\frac{3}{8}$  in. thick.

**PLATE EDGE PLANING MACHINES**  
with rack or screw drive, cutting power from 1-2 tons.

**PUNCHING MACHINES**  
from 160 tons.

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from 160 tons.

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from 125 tons.

**MECHANICAL STRAIGHTENING AND  
BENDING PRESSES**  
from 200 tons.

**HYDRAULIC PRESS BRAKES**  
from 160 tons.

**MECHANICAL PRESS BRAKES**  
from 200 tons.

**SINGLE STANDARD ECCENTRIC PRESSES**  
single and double sided from 200 tons.

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from 200 tons.

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from 200 tons.

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cutting out  
costs ... |

Manufacturers of machine tools are half way there when they start with mechanical tubing. In either large or small diameter, in various sizes, lengths and finishes our mechanical tubing can, in most cases, be despatched to you IMMEDIATELY.

...with

## Markland Scowcroft

## MECHANICAL TUBING

The use of mechanical tubing saves time, labour and materials especially in the manufacture of rollers and ring-shaped machine parts. Write, 'phone or call for full particulars



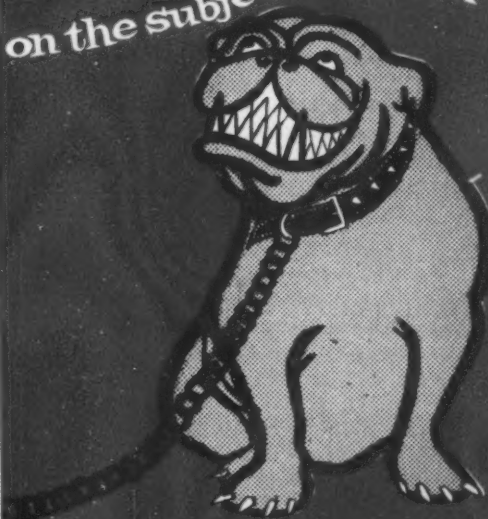
**MARKLAND SCOWCROFT LIMITED**

**Cox Green Works, Bromley Cross, Nr. Bolton**

Telephone EAGLEY 600 (5 lines)

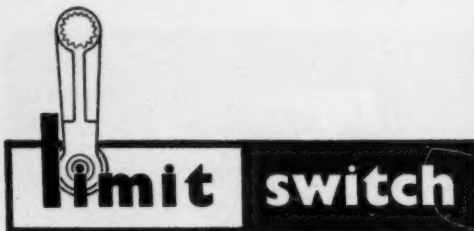
MI

on the subject of teeth



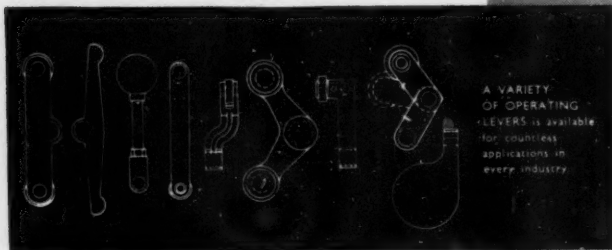
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For all heavy duty limit switch applications, particularly those to withstand conditions of extreme severity, there is a suitable B.S.A. ACME SNAP-LOCK of either water, oil, and dust proof, or flameproof versions.

The superiority of this switch is due largely to the simplicity but ruggedness of its mechanical and electrical units contained in separate compartments within a robust housing. Unique Snap-Lock design ensures self-wiping quick make and break, positive contact, maximum resistance to wear, and accurate repetitive tripping.



A VARIETY OF OPERATING LEVERS is available for countless applications in every industry.

#### NEUTRAL POSITION

These limit switches are available in Neutral Position versions. Spring-loaded devices return the operating lever to the central (neutral) position. One or both of the springs are removable for various circuit arrangements. A third spring is supplied for converting to one normally made and one normally broken circuit.

**B.S.A.  
ACME**



MADE UNDER LICENCE FROM  
NATIONAL ACME CO. U.S.A.

**snap-lock**

B.S.A. TOOLS LTD. BIRMINGHAM.33.ENGLAND

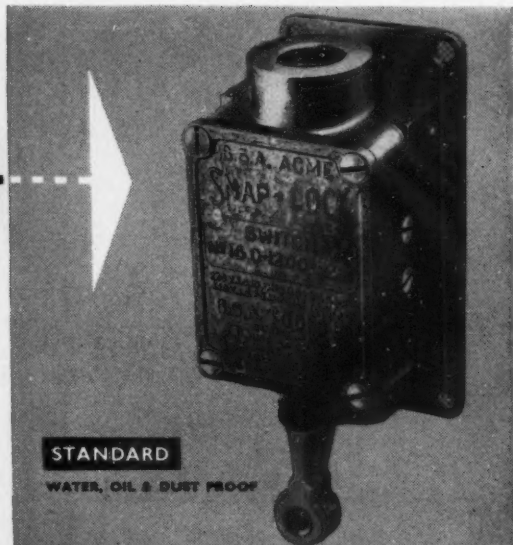
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**BURTON GRIFFITHS & CO. LTD.**

Snap-Lock Division : 93 Albert Embankment, London, S.E.11

Phone : RELIANCE 3891

Ad. No. 431



**STANDARD**

WATER, OIL & DUST PROOF



**FLAMEPROOF**

SINGLE OR DOUBLE ENTRY



3574 GROUP I  
3575 GROUP II

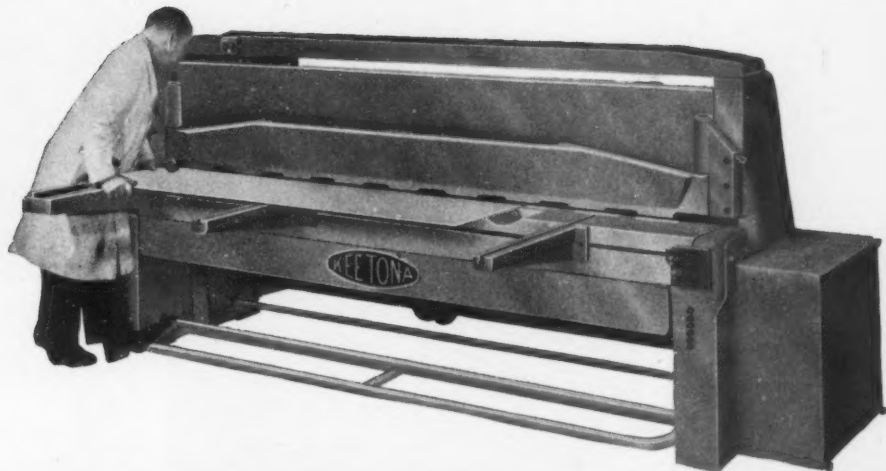
#### STANDARD

Single pole, double break, double throw, operates with either circuit normally open with other closed, or maintaining in either position, or available with central neutral position. Heavy die-cast case. Water, oil and dust proof. Conduit  $\frac{1}{2}$  in. B.S., or No. 3 Admiralty Pattern Cable gland entry. Two-screw side mounting or backplate mounting in two styles, or Tandem style (back to back mounting). Operating lever position adjustable in 7.5 deg. increments through 82.5 deg. either way from normal.

#### FLAMEPROOF

Buxton certificates No. 3574 (Group I) No. 3575 (Groups II and III gases). Meehanite iron castings. Self wiping solid silver contacts. Interchangeable plugs and sockets. Internal mechanism removable as a unit for servicing. **Single SWA cable entry (standard); double entry if required.** Operating lever position adjustable in 7.5 deg. increments through 360 deg. Single pole, double break, having one normally closed and one normally open circuit. Available with central neutral position.

# A new 8' x $\frac{1}{8}$ " guillotine from Keetons



We have designed a new Guillotine Shear in order to meet the present day demands of industry for first class Machine Tools at low prices. This Guillotine now in production, is illustrated above.

Modern plant installed in our new factory, together with efficient production methods and good design, enable us to offer you a superlative shear at a considerably reduced price. Exhaustive tests have proved its outstanding performance in reliability and ease of operation. Sheets up to the full capacity of the shear are cleanly cut to accurate limits normally associated with shears of much higher price. Write for full descriptive leaflet today. Stocked and supplied by leading machine tool merchants.



**KEETON, SONS & CO. LTD.**

KEETONS WORKS, GREENLAND ROAD, BIRMINGHAM 6



A member of  
the Firth Cleveland  
Group

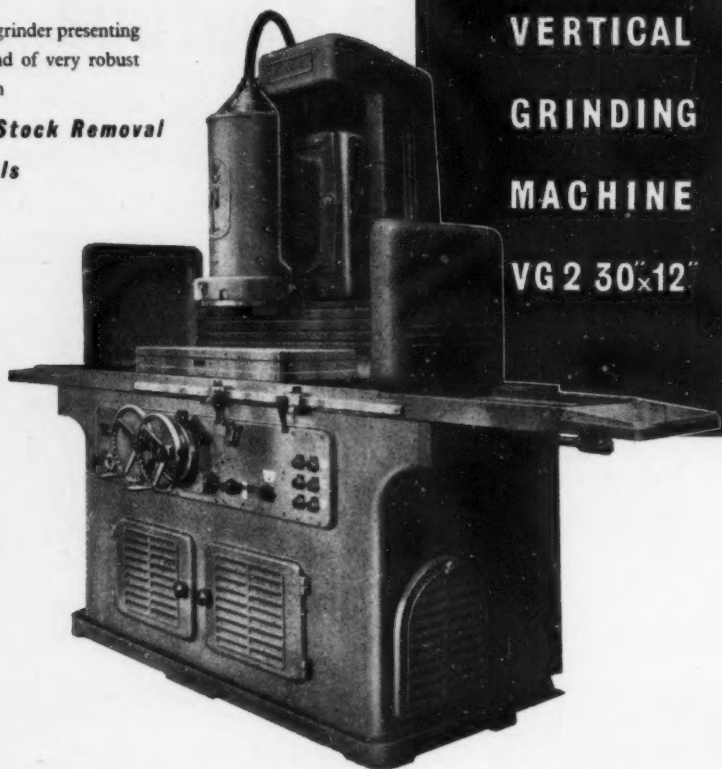
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# THE BRITISH NORTHROP

An ultra-modern precision grinder presenting a large working surface and of very robust and rigid construction, with

- *A High Rate of Stock Removal*
- *Sensitive Controls*
- *Hydraulic Feed*



**VERTICAL  
GRINDING  
MACHINE  
VG 2 30"x12"**



## TABLE

working surface, length x width . . . . .	30" x 12"
longitudinal traverse . . . . .	45"
table speed . . . . .	0-48 ft/min
admits between table and wheel . . . . .	12"

## HEAD

vertical movement of wheelhead . . . . .	13"
speed of wheel . . . . .	1420 r.p.m
peripheral speed of wheel . . . . .	4750 ft/min
diameter of wheel . . . . .	12"
movement of head per revolution of handwheel . . . . .	.050"

Write for full particulars to—

**BRITISH NORTHROP LIMITED • BLACKBURN • ENGLAND**

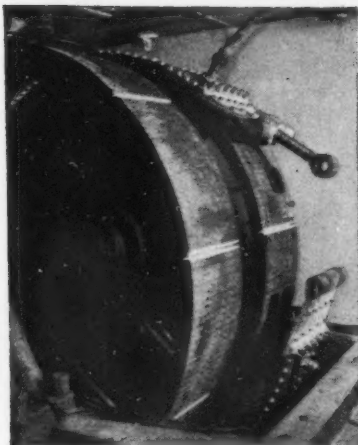
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**15 miles of unsupported cable!**



Ferodo Friction Linings were selected, after extensive tests, for 4 weeks' severe retardation braking on the pay out gear of H.M.T.S. Monarch. She crossed 2,200 miles of the Pacific, from San Francisco to Honolulu, laying two repeatered telephone cables—sometimes to a depth of three nautical miles, the deepest ever laid.

Long before this voyage, the manufacturers and designers of "Monarch's" cable engines and gear knew the existing brakes would be unable to take the increased strain expected in the Pacific. So they called in Ferodo for technical advice on choosing the ideal friction material.

**\* Ferodo welcome your friction problems**

# FERODO

## FRICITION LININGS FOR INDUSTRY



FERODO LIMITED · CHAPEL-EN-LE-FRITH    *A Member of the Turner & Newall Organisation*

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Your problem of chipbreaker grinding can be solved by the combination of the Neven diamond impregnated chipbreaker wheel used in conjunction with the G.F.3 Mark II Universal Cutting and Tool Grinding Machine. The G.F.3 machine can also be supplied with an automatic traverse and we will be pleased to arrange a practical demonstration of this equipment.

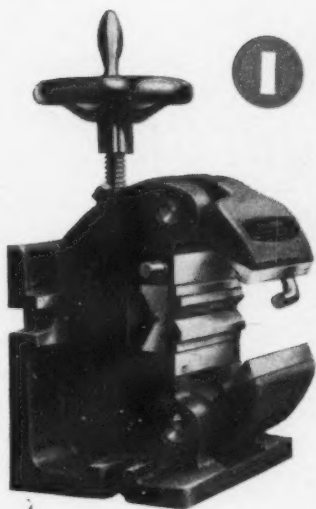
SOLE AGENTS FOR NEVEN TOOLS  
FOR TUNGSTEN CARBIDE  
APPLICATIONS IN THE UNITED  
KINGDOM, MESSRS. WICKMAN  
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**IDP**

**IMPREGNATED DIAMOND PRODUCTS LTD  
OF GLOUCESTER · ENGLAND**

TELEPHONE 21164 (3 LINES) · TELEGRAMS IMPREG GLOUCESTER

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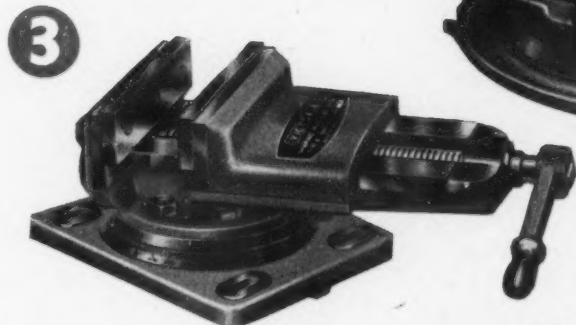


1

# The range of **VICTORIA** VICES

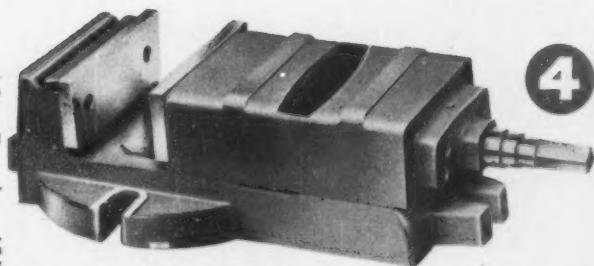


2



3

**ALL VICTORIA VICES  
ARE GUARANTEED  
AGAINST BREAKAGE**



4

**SELF CENTERING SHAFT VICE**

4½ in. width of jaws. Round bar capacity, ½ in.—3½ in. dia. Bases accurately machined at 90° to each other.

**ALL STEEL UNBREAKABLE MACHINE VICE**

3½ in., 4½ in. or 6 in. width of jaws. Plain or swivel base models. Precision ground jaws.

**HEAVY DUTY MACHINE VICE**

7½ in., 9½ in., 10½ in. or 11½ in. width of jaws. Hardened and precision ground jaws.

**SEMI STEEL MACHINE TOOL VICE**

3 in., 4½ in., or 6 in. width of jaws. Two 6 in. models either 5 in. or 6 in. opening. All sizes available with either plain or swivel base. New design eliminates use of dovetails and provides clear flat supporting area between the jaws.

**OBTAINABLE FROM LEADING ENGINEERING TOOL MERCHANTS**

Manufactured by

**B. ELLIOTT (MACHINERY) LTD.**

(MEMBER OF THE B. ELLIOTT GROUP)

**VICTORIA WORKS, WILLESDEN, LONDON, N.W. 10**

Telephone: ELGAR 6956 (10 lines) Telegrams: Ellittons, Harles, London

Overseas Subsidiaries: CANADA, U.S.A., AUSTRALIA, S. AFRICA



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# Now there are 4 new SURFORMS

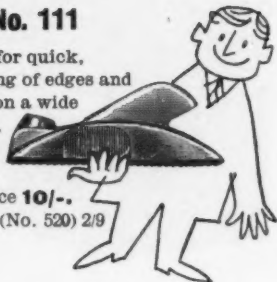
## FINE-CUT FILE No. 102

This SURFORM file has been developed specially for mild steel and other tough materials. The cutting principle is the same, but the teeth are set at a different cutting angle, giving a clean cut and a smooth finish. Price **12/6**. Replacement blades (No. 506) 3/6.



## BLOCK PLANE No. 111

This fine cut tool is for quick, one-handed smoothing of edges and small surface areas on a wide variety of materials. You will find scores of uses for it round your workshops. Price **10/-**. Replacement blades (No. 520) 2/9.



## CONVEX PLANE No. 105

Although developed for the car-body repair trade and for spot-trimming, this fine cut convex SURFORM is very fast and efficient on wood too and is recommended for the furniture and cabinet making industry. Price **17/6**. Replacement blades (No. 506) 3/6.



## HALF ROUND FILE No. 103

Here's another tool for which we've had plenty of requests. It gives first class results on concave surfaces and will serve many trades. Price **13/-**. Replacement blades (No. 507) 4/3.



*The universal tool with hundreds of uses!*  
**SURFORM**

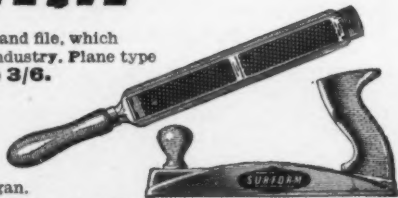
The above tools are supplementary to the original SURFORM plane and file, which remain the ideal all-purpose cutting and finishing tools for every industry. Plane type (No.107) **17/6**. File type (No.101) **12/6**. Replacement blades (No.506) **3/6**.

SURFORM blades (an invention of Firth Brown Tools Ltd.) are made from hardened and tempered Sheffield tool steel—they give controlled depth of cut and never clog with waste material.



A product of **SIMMONDS AEROCESSORIES LIMITED**, Treforest, Glamorgan.

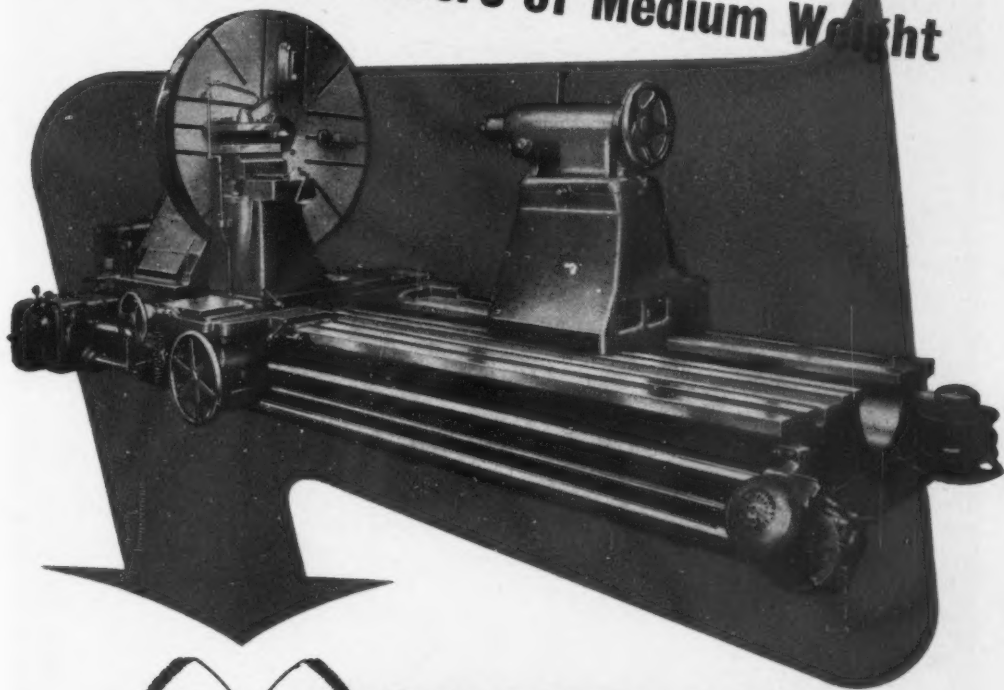
A MEMBER OF THE **FIRTH CLEVELAND GROUP**



CRC2987

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# For Turning **LARGE** Diameter Drums and Rollers of Medium Weight



## DRUM LATHE

Built with traditional O & S quality and workmanship and embodying the latest advancements in Drum Lathe design.

The O & S Drum Lathe incorporates all these features:

- Up to 6' swing over saddle
- Up to 25' between centres
- 12 spindle speeds
- Large hollow spindle
- Spindle bearings PB or Taper Roller
- 32 enclosed change feed and screw-cutting box
- Long lead cutting gear
- Quick power motion to saddle
- Power feed to compound top slide if required
- Power feed to loose headstock if required
- 30 or 35 h.p. motor drive

The O & S Range also includes:  
SS & SC lathes from 10½ in. to 24 in. capacity; surfacing and boring lathes up to 96 in. swing; break lathes; axle lathes; rail-ways carriage and wagon wheel lathes; axle journal turning and burnishing lathes; straightening presses.

Write for full particulars

OLDFIELD & SCHIFFIELD CO. LTD. BOOTH TOWN · HALIFAX · YORKS. Tel: Halifax 5937-8  
A KERRY COMPANY

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FOR HIGHER PRODUCTION

# MACHINE TOOL DIRECTORY

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**MANHURIN** Single Spindle machines.  
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**NASSOVIA-LINSTEADT** Vert. Rotary  
Chuck, Arches, and Univ. Drum Autos.  
Germany  
**NASSOVIA HANNS FICKERT** G.m.b.H.  
Germany  
**PITTLER ACHE-GRIDLEY** 4, 6- and  
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**PITTLER Maschinenfabrik A.G.** Germany

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**DY-NAMIC** Static Machines.  
Bear Manufacturing Co. ....U.S.A.

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Single and Multi-spindle machines.  
Ernst KRAUSE & Co. ....Austria

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Wide range of traversing column  
machines.  
**William ASQUITH Ltd.** ....Halifax

## BORING MACHINES

Horizontal Table Type  
Universal machines for precision  
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Spindle diameter up to  
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Portable m/c. up to 1 1/2 in. dia.  
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Auto. and semi-auto for high pro-  
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Wide range of sizes and capacities  
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Multi-Spindle  
Auto. machines for high production.  
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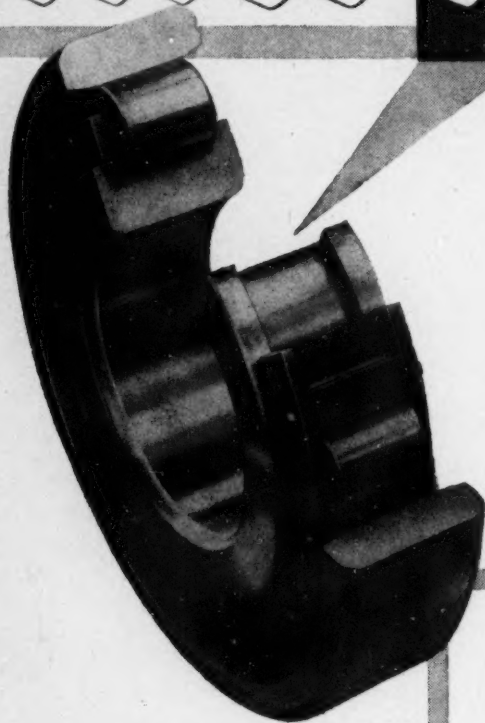
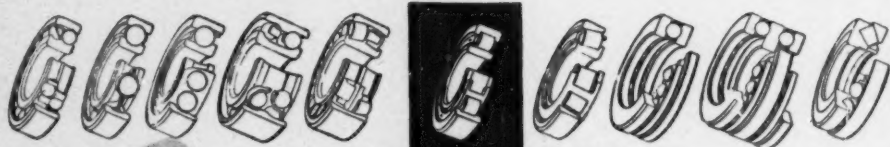
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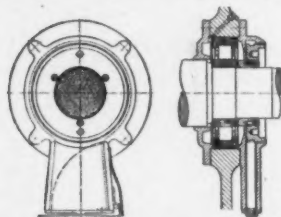
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[p. 1489] K

## Abstracts of Principal Articles

### The Production of Calculating and Ticket-issuing Machines .....P. 1492

In the manufacture of their wide range of products, which includes calculating and ticket issuing machines, totalisator equipment, taximeters and aircraft instruments, the Bell Punch Co., Ltd., Uxbridge, pay marked attention to the maintenance of high standards of accuracy and surface finish. Various grinding techniques are adopted, and on small pressings, known as drive pawls, a flat and a radius are ground in a precise relationship to each other and to a pivot hole. Parts are ground four at a time with a Dia-formed wheel, and are checked in a special fixture that incorporates a dial indicator. Small cams are ground with the aid of a special attachment, with the stack of workpieces mounted on a mandrel. The mandrel is held between centres on a swinging platform, which is oscillated by means of a master cam, in phase with the rotation of the work. Form grinding with a crushed wheel is extensively employed, and a specially-equipped machine has been installed. Two crushing rolls are used alternatively, one for rough-forming and the other for finish-forming, the wheel, the roughing roll being trued with the freshly formed wheel, and used subsequently for finish forming. Certain profiles are generated by special cutters on a gear-shaping machine, and for cutting slots in small gears the company have tooled-up and developed an indexing-table machine, with automatic work-ejection arrangements. (MACHINERY, 92/1492—27/6/58.)

### Employment of the Blind in Industry P. 1501

Since the second world war, when the labour shortage provided new opportunities and incentives for the employment of the blind in industry, there has been considerable progress in this field, due largely to the efforts of the Royal National Institute for the Blind, and the Ministry of Labour and National Service training centre at Letchworth. To their efforts may be attributed the growing realization among employers, that, in selected occupations for which they have been suitably trained, the blind are able to maintain the full industrial standards of productive efficiency on terms of complete equality with the sighted. Among the attributes of the blind worker are great powers of concentration; freedom from visual distractions; high working morale; highly-developed sense of touch and "spatial perception"; self-dependence; low accident-rate; and the habit of deliberate, methodical movement, well suited to working on time-study principles. Suitable subjects are given a rehabilitation course at two R.N.I.B. centres, followed by industrial training at the Letchworth centre. At the latter, instruction is given in machine work, inspection, and assembly, under normal factory conditions, including stipulated rates of output. Placement of the trained operator is effected through the Employment Service of the R.N.I.B., and their employment and training officers. (MACHINERY, 27/6/58.)

### Superston Bronze ..... P. 1509

Superston bronzes are now being made by J. Stone & Co. (Charlton), Ltd., with a range of compositions which provide properties suitable for a diversity of applications. It is claimed that all these bronzes have casting characteristics which permit savings in weight, cost, and machining time. Recommendations for machining are included, and reference is made to the plastic working and corrosion resistant properties of the alloys. Superston-40, which can be hardened to 350 Brinell, may be employed for the production of non-sparking hand tools. (MACHINERY, 92—27/6/58.)

### The Analysis of Hobbing Machine Periodic Error Diagrams ..... P. 1513

The procedure for recording those periodic errors in table motion which are likely to produce inaccuracies in gears cut on hobbing machines is first briefly outlined. It is then pointed out that errors in the wormshaft-to-table motion may be due to the wormshaft locating faces, the worm itself, the worm-wheel itself, and the worm-wheel shaft location, whereas many additional elements are involved in the hobshaft-to-table motion. Make-up of the error graphs is next discussed, and separate sections are then devoted to the interpretation of the wormshaft and hobshaft error graphs. (MACHINERY, 92—27/6/58.)

### Work Transfer Methods in Die Casting Production .....P. 1521

Various arrangements for the transport of work from die casting machines for subsequent processing are first discussed and the desirability of provision for storage is explained. With such a system, casting can proceed independently of the secondary operations, for which the cycle time is substantially less. A separate conveyor may be provided for each casting machine and processing line, or there may be one main conveyor with provision for switching the various castings to separate storage conveyors. The allied subject of removing castings from machines is next considered, and various transfer arrangements are discussed. In this connection sequences are described which involve manual removal of the casting from a transfer plate, automatic discharge into a chute, and automatic delivery on to a conveyor. After reference to insert loaders, it is then explained how such units may also be employed for work unloading in suitable instances. (MACHINERY, 92—27/6/58.)

### IN FORTHCOMING ISSUES

Aspects of Russian engineering industry—Production of titanium rings from extruded sections—Practical examples of the application of Ceroc sintered ceramic cutting tools—Factors affecting performance in cylindrical grinding.

## Electrical Machining

Although certain electrical processes of metal removal are now well established and have proved their value in particular applications, wider acceptance by users and further developments by the suppliers of equipment will be necessary if the potentialities of these methods are to be fully exploited. For example, it was pointed out by Mr. D. W. Rudorff, during the course of a paper presented at the Conference on Technology of Engineering Manufacture organized by the Institution of Mechanical Engineers, that whereas erosion may be achieved either by intermittent arc discharge or by spark discharge, considerable advantages would result if dual-purpose machines were made available. A machine of this type, it was stated, which is believed to be experimental, has already been built in Russia, and with such an arrangement it would be possible to carry out roughing operations by the interrupted-arc principle "at the highest rate of metal removal permitted by the nature of the electro-erosion process," and finishing operations, at the same set up, by the spark-discharge principle. In this way, substantial reductions in the overall times required for producing certain work forms might be achieved without sacrificing final surface-quality.

Electro-erosion is, of course, inherently slow as compared with the majority of machining processes, so that it must be confined at present to operations which would be difficult or impossible to undertake by other methods. In this connection, however, it was reported that an arc-type machine of Russian design is claimed to be capable of removal rates up to 24 grammes per min. when operating on carbon steel with electrodes of fairly large area. Surface finish obtained under such conditions is necessarily very poor, but provided that the material was not damaged, the superficial roughness could be corrected by subsequent spark machining.

Hitherto, electrical machining has been largely confined to tool sharpening and the production of shaped openings and cavities such as are required in press tools and moulds, the form and accuracy of the work being determined by the electrode. There are, however, many other possibilities including the machining of curved-axis holes of round or irregular cross-section, threaded holes, and elliptical holes, such as are required for branch connections to pipes. By using wire electrodes, more-

over, holes as small as 0.003 in. diameter can be "drilled," lateral arcing being prevented by means of a thin insulating coating. In addition, parting-off has been performed, for instance on uranium metal, on special machines equipped with rotating disc-type electrodes.

Because there is no significant thrust on the electrode, copying operations can readily be carried out by the erosion method, the path being controlled from a template through a pantograph system. This procedure has been successfully applied to form tools, and it was suggested by Mr. Rudorff that the technique might well be extended to 3-dimensional copying from patterns. Machines for this purpose would not require hydraulic or electric linkages, by reason of the smallness of the forces involved, but it would be necessary to provide automatic compensation to ensure that work accuracy was not affected by electrode wear. It may also be noted that contour machining, of 2-dimensional shapes, can be carried out on special machines with electrodes in the form of endless bands or wires.

Reference has already been made to the use of rotating electrodes for cutting-off, and the author went on to explain how grinding machines could be readily converted for erosion operations by the substitution of brass wheels for those of the abrasive type. Since the electrode is run at a much lower speed than a grinding wheel, vibration is reduced to a minimum. At the same time, there is much less local heating, and consequently wear, than occurs with a stationary electrode. A centreless arrangement would appear to offer interesting possibilities, particularly for operations on cemented carbides, but it is understood that although such a machine has been designed, it has not yet been put into operation.

Apart from the erosion techniques that have been considered so far, there are some other electrical methods of metal removal that should be mentioned. The electrolytic process, for instance, although it has not proved successful for the production of accurate apertures and holes, has been effectively employed for tool sharpening and other surface finishing operations. For these purposes, machines are commonly equipped with diamond-impregnated wheels, but special types of silicon-carbide and cast iron wheels have also been used.

*(Continued on page 1539)*

## The Production of Calculating and Ticket-issuing Machines



**Methods and Equipment Developed for the Batch Manufacture of a  
Wide Variety of Precision Components by the Bell Punch Co., Ltd., Uxbridge**

In the first article\* in this series devoted to the manufacturing methods of the Bell Punch Co., Ltd., The Island, Uxbridge, Middlesex, the growth of the company was traced, from its foundation in 1878, and the development of its wide range of products was outlined. It was pointed out that the demand for the firm's machines and instruments varies considerably, some units being required in very large quantities, whereas others are made only in small numbers. Batch production methods are adopted, and in a typical 3-month period some 12,000 different types of parts may pass through the machine shop of the Uxbridge works, where about 200 operators are employed. It was emphasized that the company has fostered an open-minded approach to machining problems, and has installed an extensive range of general-purpose machines, which permits a considerable degree of flexibility in the methods that are employed. The machines may be used in a somewhat unconventional manner, if the desired results can best be achieved in this way, and, in the preceding article, reference was made to the use of engraving machines for milling operations and a tapping machine for precision reaming. On many of the company's components, particular attention must be paid to accuracy of form and quality of finish, in order to ensure efficient and trouble-free operation of the units in which they are used. In this article, some further examples of precision-finishing and other operations will be considered.

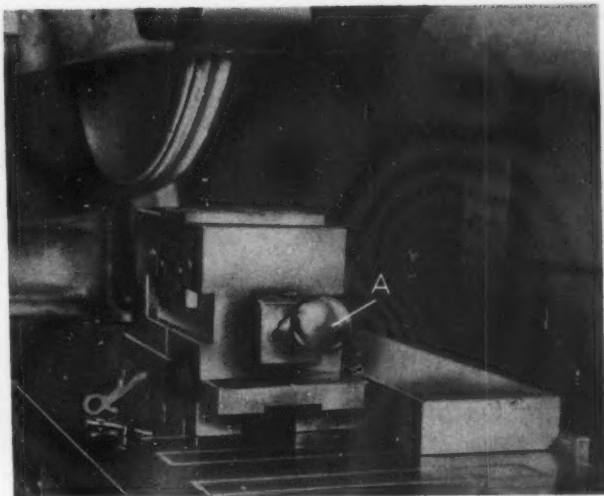
### GRINDING DRIVE PAWL PRESSINGS

The mechanism of the Sumlock calculating machine is built up mainly from pressings, and includes certain components known as drive pawls, which are hardened. Each pawl is of bifurcated form, and at the end of one arm of the pressing there is an edge-face which must be finished smooth, accurately flat and at 90 deg. to the other arm. This second arm is twisted adjacent to its junction with the main body of the pressing, so that its wide faces are at 90 deg. to the wide faces of the main body. The end of the second arm is required to be formed to a 0.022/0.026-in. radius, with the crest of the semi-circular form at a predetermined radius from the pivot hole in the pawl, within  $\pm 0.0005$  in.

To facilitate the maintenance of the specified tolerances and dimensions, and to ensure a smooth finish on the radiused portion and the flat edge-face, the pressings are form ground before they are hardened. The set-up, on an American Abrasive No.3.S surface grinding machine, is shown in Fig. 1, and two pressings may be seen at the left. Pressings are ground four at a time, and the radiused-end and the edge-face on the arms of each part are finished simultaneously. The fixture employed has a fixed and a moving jaw, the moving member being spring-loaded away from the fixed jaw, and pulled towards it by the action of a draw bar. This bar is pivoted between the clevis-arm of the lever A, and the arm has a cam form machined on its inner end, which bears against the face of the fixed jaw. The fixture is mounted

\* MACHINERY, 92/1192-23/5/58.

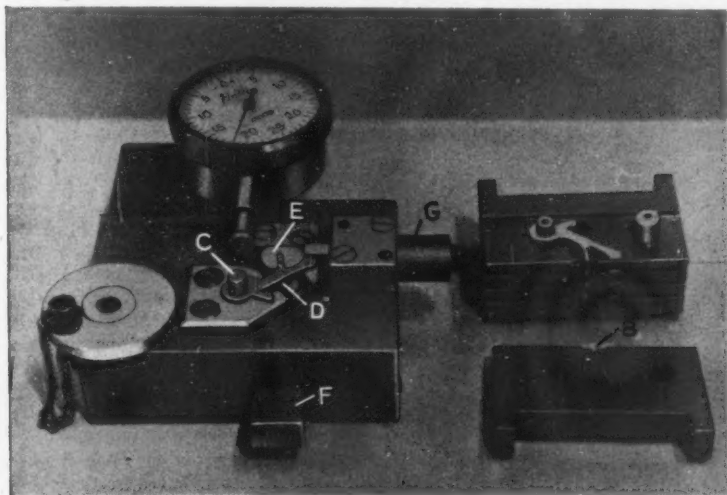
**Fig. 1. This Set-up on an Abrasive No. 3 S. Machine Provides for Grinding the Edge-face at the End of One Arm of a Drive Pawl Pressing, and a 0.020/0.026-in. Radius at the End of the Other Arm. The Edge-face must be at 90 deg. to the Second Arm, and the Radius-end must be at a Specified Distance from a Pivot Hole, Within Close Limits**



on an Eclipse permanent magnet chuck, clamped to the machine table, and is aligned with the direction of table travel by setting it against the side face of a parallel block, which is held in contact with a strip secured to the edge of the chuck. A Carborundum abrasive wheel, to the 7A-100/G5/VF8 specification, is used for the grinding operation. The wheel is run at a speed of 5,000 ft. per min., and a cylindrical portion and a groove of the required shape are produced on the periphery by means of a Diaform unit. It has been found that, when a wheel of this type is run at the speed stated, a batch of 2,000 pressings can be ground before re-dressing is necessary.

The pressings are held in sets of inserts which are clamped between the jaws of the fixture, and the floor-to-floor time for each load is 2.8 min. A set of jaw inserts may be seen at the right in Fig. 2. There are two thick inserts, which occupy the end positions in the stack, and one of these thick inserts has been removed and placed in the

foreground. The thinner inserts, which are clamped between the thick members, serve to separate the workpieces. One thick insert has two hardened pins, of different diameters, which pass through mating holes in the other inserts to align them accurately. At the bottom of each insert there is a rectangular slot, and the mutually-perpendicular faces of the slots in all the inserts are ground to close limits, after the complete set has been assembled. When the set of inserts is loaded into the fixture, the horizontal and vertical faces of the slots engage the top and side faces of



**Fig. 2. A Set of Inserts for Holding Drive Pawl Pressings in the Fixture on the Grinding Machine is Seen at the Right. The Gauge Employed for Inspecting the Ground Pressings is at the Left. It incorporates a Dial Indicator for Checking the Position of the Rounded End of One Arm Relative to the Pivot Hole, and a Sliding Stepped Plunger for Checking the Angular Relationship of the Two Arms**

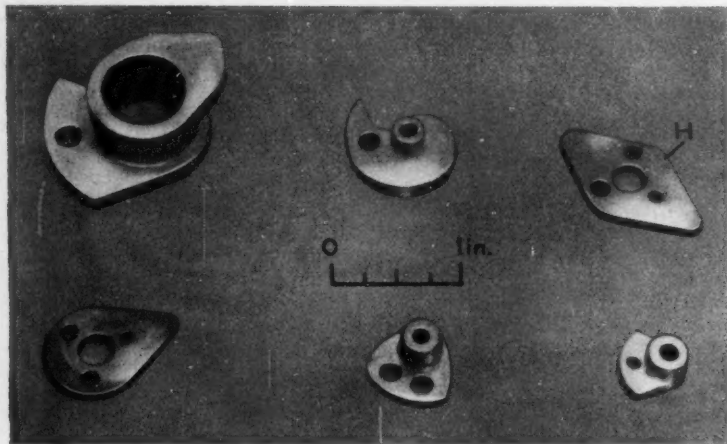


Fig. 3. Machines and Instruments Produced by the Bell Punch Co., Ltd., Incorporate Cams, which are Machined from Bar Stock or Made by Blanking, for Example. The Cam Profiles must be Smoothly and Accurately Finished, and the Peripheries of the Cams Shown are Ground with the aid of Special Equipment Developed by the Company

the fixture body, between the jaws, thereby aligning the inserts and workpieces accurately at the correct height.

When the drive pawls are loaded, the hole in each pressing is passed over the smaller of the two locating pins, so that the holes in all four pressings are aligned. A shallow relief is machined in the top face of each insert, and in the centre of this relief there is a narrow groove, as indicated at *B*. An oval depression is machined in both sides of the thin inserts, and in one side of each thick insert, and the relative positions of the depressions and grooves are such that two narrow ribs of metal are left below the relief face (on each side of a thin insert, and on one side of a thick insert). These ribs contact the sides of the secondary arms of the pressings, to locate them angularly, and the depressions provide clearance for the portion of each arm that is disposed at 90 deg. to the body of the pressing.

The gauge seen at the left in Fig. 2 is provided for checking the position of the crest of the secondary arm relative to the hole in the pressing, also the relationship of the arm to the ground flat. A Batty dial indicator is incorporated in the gauge, and is calibrated to read directly in 0.0005 in. increments. This gauge is set to zero with its anvil face in contact with the periphery of a precision-ground disc, which is fitted on the peg *C*, and this disc may be seen at the left.

A ground workpiece is indicated at *D*, and it will be seen that it is loaded with the hole embracing the peg *C*. It is shown in the position for checking the relationship between the flat and the secondary arm. In the gauge-body, there is a vertically-sliding plunger *E*, which can

be raised by depressing the lever *F*. The secondary arm is engaged with a slot in the plunger, when the latter is in the raised position. At the right-hand side of the gauge there is a sliding blade *G*, with a step machined at its left-hand end to provide "go" and "not go" gauging surfaces, the height of the step being 0.002 in. These gauging surfaces are disposed accurately at 90 deg. to the slot in the plunger, and, therefore, to the secondary arm. As the blade is moved towards the workpiece, the "go" step-face must pass over the ground flat on the pressing, and the "not go" face must foul it.

For checking the relationship of the secondary arm to the hole in the pressing, the plunger *E* is lowered, and the pressing is swung in an anti-clockwise direction until the crest of the secondary arm contacts the flat anvil of the dial indicator. The pressing is rocked to and fro to obtain a maximum reading, and this reading must be within  $\pm 0.0005$  in. of the zero setting.

#### GRINDING SMALL CAMS

The calculating and other machines made by the company incorporate cams of various sizes and types, and a group of these cams is shown in Fig. 3. Some cams are machined from bar stock and others are made by blanking from strip material. It is essential that the cam profiles are smoothly and accurately finished, and, for this purpose, the company has designed and built grinding attachments for use on standard machines. One of these attachments, which has been developed from an earlier unit, is seen in Fig. 4, set-up on a Brown & Sharpe No. 2 universal grinding machine for

finishing the key re-setting cams for self-printing ticket issuing machines, and these components are of the form indicated at *H* in Fig. 3. Eight of these cams are ground simultaneously, and a stack of cams may be seen at *J* in Fig. 4.

As may be observed, the fixture has a heavy cast-iron base, which is clamped to the machine table. Sleeve-type bearings are fitted in brackets integral with the base casting, and serve to support the trunnions of the platform *K*. This platform is free to swing through a limited angle, and the side remote from the trunnions is pulled downwards by two tension springs.

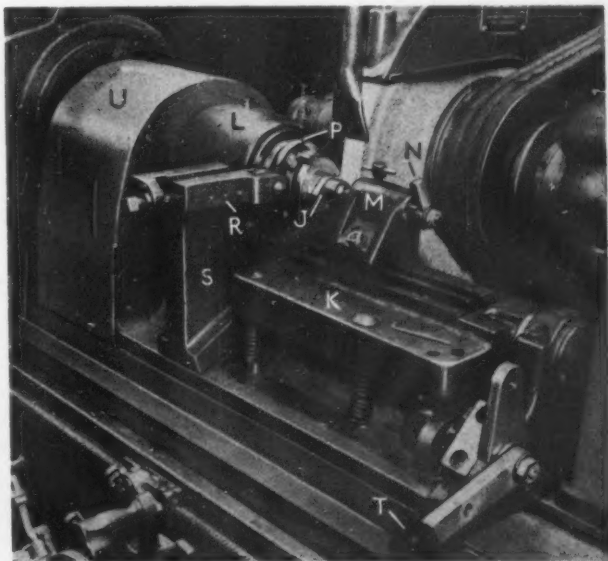
Integral with the platform, at one end, there is a cast housing *L* with bearings for the work-spindle, and a dovetail slideway on top of the platform carries a tailstock unit *M*. The tailstock body can be clamped in any position on the slideway, and the tailstock quill can be withdrawn against spring pressure by means of the lever *N*, and locked in any setting by a thumb screw. A cam, or stack of cams, to be ground is mounted on a special mandrel, which is held between centres in the work-spindle and the tailstock quill. Drive is transmitted by a dog on the mandrel, which is gripped between two screws on a driver secured to the work-spindle.

Between the driver and the front face of the spindle is clamped a master-cam *P*, the periphery of which is held in contact with the roller of the follower unit *R*, by the action of the platform springs. The follower is adjustable in a horizontal slot in the vertical pillar *S* of the base casting, and can be locked in position by screws. As the work-carrying mandrel is rotated, the action of the master-cam against the follower causes the platform, and with it the work, to oscillate, and the form of each master-cam has been developed so that the desired profile is ground

on the stack of workpieces. The cams are located positively on the mandrel, and the mandrel is located in the correct position relative to the master cam by the twin screws of the driver. These screws have sufficient travel to permit of slight adjustment between the work and the master cam during initial setting. The attachment is used for grinding a variety of cams, and the follower is set in different positions to suit the various workpieces, these positions being indicated by index-marks on the pillar. For loading certain workpieces, it is necessary to tilt the platform, and a cam is provided for this purpose, which is rotated by means of the lever *T*.

The work-spindle of the attachment is driven at 64 r.p.m. from the headstock of the grinding machine. Drive is transmitted from the headstock spindle to the work-spindle by gearing, housed under the cover *U*. A gear on the headstock spindle meshes with a long gear on a shaft that is co-axial with the trunnions of the platform. A third gear on the end of the work-spindle is in mesh with this long gear, and the arrangement is such that the work-spindle gear can follow a planetary path about the long gear as the trunnion-mounted platform is oscillated.

Since most of the cams that are ground are made from steel and are hardened, Carborundum W.46.A abrasive wheels are used, and are run at a surface speed of 4,800 ft. per min. The maxi-



**Fig. 4. A Specially-developed Cam Grinding Attachment is Here Seen on a Brown & Sharpe No. 2 Universal Machine. A Stack of Cams is held on a Mandrel which is Mounted between Centres on a Swinging Platform. The Platform is Oscillated by a Master Cam on the Workhead Spindle, which is Driven from the Machine Headstock**

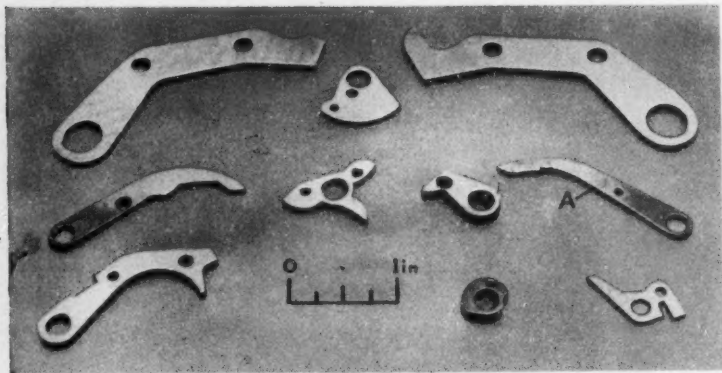


Fig. 5. A Group of Components for Calculating and Other Machines on which Certain Portions of the Work-profiles have been Finished by Grinding with a Crush-formed Wheel on a Specially-equipped Jones-Shipman Fig. 1010 Machine

mum size of wheel that can be employed is 15 in. diameter, and the wheels are used until this diameter has been reduced to 13 in.

#### CRUSHED-WHEEL FORM GRINDING

Form-grinding by the crushed-wheel technique is employed for finishing certain contact surfaces on other components such as levers, pawls and cams, and a group of parts that have been finished in this manner is shown in Fig. 5. The close-up view, Fig. 6, shows the set-up for finishing the pointed end of the component indicated at A in Fig. 5, on a Jones-Shipman Fig. 1010 hydraulic surface grinder equipped with twin roll-crushing units. This component is incorporated in the taximeter seen in the heading illustration (which is exported in large quantities to Canada). The machine has been installed specially for this method of finishing, and the technique has been developed in close collaboration with A. A. Jones & Shipman, Ltd.

An Eclipse permanent magnet chuck is mounted on the work-table of

the machine between the two roll-carrying units. For the form-grinding operation, the workpieces are clamped in a fixture, in stacks of eight parts, as indicated at B. The fixture has a base of inverted-T section, with a spring-loaded clamp-plate C. This plate is carried on two horizontally-disposed pins and can be urged towards the fixture body, to clamp the workpieces, by means of a knurled nut on a stud that extends outwards from the body and passes through a hole in the plate. On the fixture, the workpieces are located by a pin that passes through the large hole at one end, and their smaller ends rest on a support attached to the fixture body. The upper edges of the body and the clamp plate are machined to a profile that provides clearance

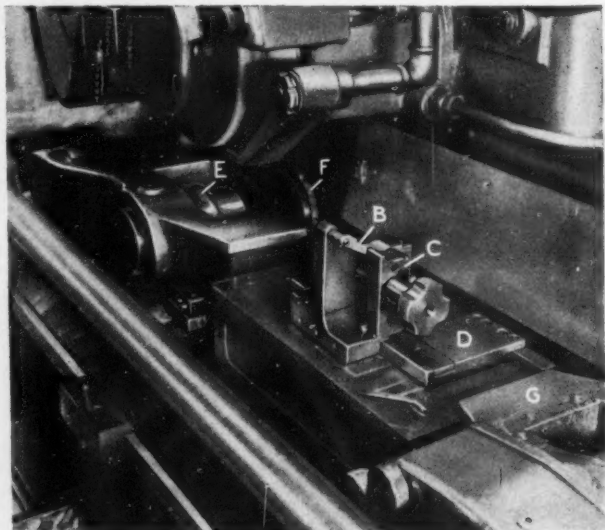
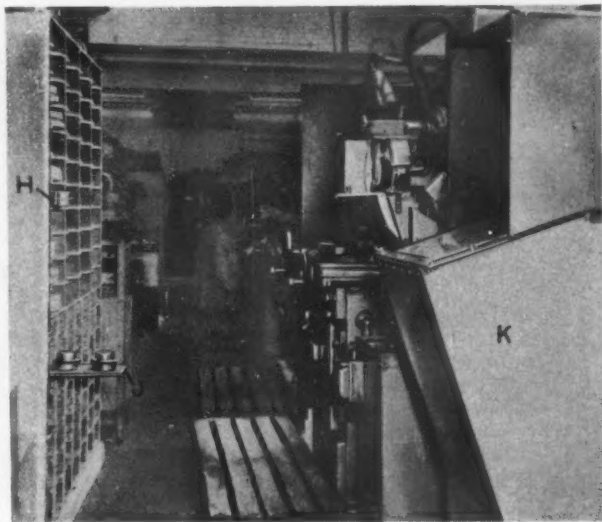


Fig. 6. Close-up View of the Set-up on the Jones-Shipman Machine for Grinding the Pointed Ends of Taximeter Components, Simultaneously, Eight per Load. The Machine has a Freely-rotating and a Motor-driven Roll, One being Used for Rough-forming and the Other for Finish-forming the Wheel. The Roughing Roll is Trued-up with the Freshly-crushed Wheel and is Employed for Finishing at the Next Forming Operation

**Fig. 7. In this View of Part of the Grinding Section at the Uxbridge Works, the Jones-Shipman Machine for Crush-form Grinding is Seen towards the Right, with the Optical Projector Used for Inspecting Ground Workpieces. At the Left is the Special Rack which has been Built for Storing the Crushing-rolls and the Formed Grinding Wheels**



for the grinding wheel, as the fixture is traversed beneath it.

Fixtures of a similar type are employed for the other workpieces that are form-ground, and, to facilitate location of the fixtures, the magnetic chuck is provided with a nest, with which the fixture bases are engaged. A strip is secured to the long side of the chuck, nearest to the wheel head of the machine, and two plates are screwed and dowelled to the strip, one of the plates being seen at *D*. Grooves are machined in the plates to receive a parallel strip, which is screwed and dowelled in position. Each fixture is mounted on the chuck with its base between the projecting portions of the plates, and a location slot in the base embracing the parallel strip.

When set-up in the manner described, the inner (datum) edge of the fixture is in alignment with the flat inside faces of the crushing rolls, one of which is seen at *E*. Then, the side face of the abrasive wheel nearest to the wheel-head is aligned with the inside face of the rolls. The latter are made from high-speed steel, and are hardened and ground. Rolls can be changed readily, once a locking nut (as indicated at *F*) has been removed. Although there is an easier crushing action on the nominally-vertical surfaces of the wheel form, it is found that those surfaces of the wheel and roll are subjected to greater wear, due to rubbing, and to avoid excessive re-grinding of the rolls, to maintain the form on the workpiece within the prescribed limits, the following procedure has been adopted.

Crushing is performed in two stages, and the roll *E* is seen in the finish-crushing position, where it rotates freely on the fixed spindle of the roll-carrying unit. Rough-crushing is performed with the roll mounted in the carrier *G*, and the roll spindle of this unit can be driven by an f.h.p. motor. This motor is flange-mounted on the outer end of the carrier frame, and is not visible

in Fig. 6. For the crushing operations, the abrasive wheel of the machine is run at a surface speed of 315 ft. per min. When it has been finish-crushed by the freely-rotating roll, the freshly-formed wheel is used to true the roll that was employed for rough-crushing. The wheel is run at the normal grinding speed, and the roll is driven at a surface speed of about 40 ft. per min. After it has been trued, the roll in the motor-driven unit is transferred to the carrier at the opposite end of the machine in readiness for finish-crushing at the next re-dressing stage. The roll previously employed for finishing is mounted in the motor-driven carrier and is used for roughing at the next dressing operation.

After it has been used to true the crushing roll, the freshly-formed wheel is employed to grind a batch of workpieces, and it has been found that from 900 to 2,000 parts can be reground before re-dressing is necessary. From 0.008 to 0.010 in. of metal is removed from the formed portion on each workpiece, and the actual number of pieces that can be ground between successive dressing operations depends on the work-profile. Universal white bauxilite abrasive wheels are used for the form-grinding operations, and are run at a surface speed of 5,300 ft. per min. For hardened workpieces, a wheel of type WA 150 MV is used, and for soft parts, a wheel of type WA 100 MV. The wheels are mounted with care to ensure that they are running true, and the form that is crushed is "balanced" with respect to the wheel face width. With the procedure that has been described, it

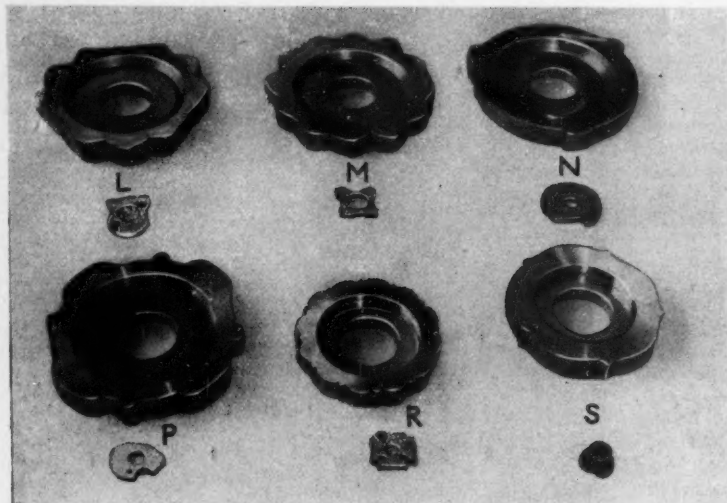


Fig. 8. A Group of Workpieces with Profiles that have been Generated on a Fellows No. 7 High-speed Gear Shaper. The Specially-developed Cutter Employed is Seen above Each Component. Most of the Workpieces are of Steel, but the Two Cams at the Right are Machined from Tufnol

has been found that the profiles of the crushing rollers are maintained within close limits over long periods. During the past three years, for example, only one set of rolls has had to be reground, and this set is for a particularly difficult component which has several small radii, and faces that are nearly perpendicular to the roll axis.

Formed wheels and crushing rolls are stored in a specially-constructed rack adjacent to the Jones-Shipman machine, and this rack may be seen at the left in Fig. 7, with the machine at the right. The rack has a series of pigeon-holes, one for each type of wheel, which are labelled for identification purposes. One of the wheels may be seen, partly withdrawn, at *H*. Below the portion of the rack devoted to the storage of wheels, there is a series of pull-out slides, each of which has a pair of pegs to receive the two crushing rolls, and an identifying label. One of the slides, with the two rolls for forming the wheel *H*, may be seen in the advanced position at *J*.

Facing the storage rack, and beside the grinding machine, is a Hilger projector *K* which is employed for checking the forms of the ground workpieces against 10:1 scale master layouts. Because of the high general level of natural illumination provided by the roof lights, the projector unit has been fitted with a sheet-metal hood, so that the working zone is in shadow. This arrangement of grinding machine, storage rack and projector is notably efficient, and all the equipment that the operator of the machine requires is located within a compact area.

#### PROFILING OPERATIONS ON A GEAR SHAPING MACHINE

In addition to the grinding and engraving techniques already described for the production of accurate profiles on various components, the Bell Punch Co., Ltd., make use of a Fellows No. 7 high-speed gear shaping machine for other workpieces with irregular profiles. A group of components that have been profile-shaped may be seen in Fig. 8, where the cutters employed are also shown. The high-speed steel cutters are supplied by Reliance Precision Tools, Ltd., The Causeway, Staines, Middlesex, or by W. E. Sykes, Ltd., Staines, Middlesex, and they are dish-shaped to provide a cutting rake of 5 deg. The workpieces are usually required in batches of about 1,000 every 3 months.

The two components *L* and *M* are made from mild steel, and, to reduce the amount of metal that must be removed, are machined from stampings, the same stamping being used for both parts. For shaping, the blanks are mounted on a plain mandrel, 8 per load, and are positioned angularly by means of a nest-type jig, which engages the flat side-faces of the two upper (as illustrated) ears of each stamping. A cam component made from Tufnol is indicated at *N*, and it is unnecessary to locate the circular blanks for these cams angularly, since the eccentric holes are machined after the profiling stage. The blanks are machined eight at a time on a mandrel. As may readily be observed, each of the cutters for the parts so far considered has three groups of cutting lobes.

At *P* is shown a mild steel component, and stacks of six of these workpieces are machined at a time. The parts are mounted on a mandrel, and a nest-type jig is employed to locate the blanks by means of the notch in one side. There are four groups of cutting lobes on the shaping cutter for this component. The Geneva wheel *R* is made from 2½ per cent nickel steel, and four workpieces are profile-shaped simultaneously. Two locating-pins are fitted to the mandrel for these workpieces and engage two of the slots, which are produced at a previous stage. The cutter has 12 groups of cutting lobes, which, in effect, form three sets, each set producing the four portions of the complete profile of the component. The smallest lobes on the cutter, it may be noted, serve only to round off the corners of the part at the outer ends of the slots. A second Tufnol cam is seen at *S*, in Fig. 8, and such cams are shaped one at a time. The workpiece is located by means of the offset hole, and a milled slot, the cutter in this instance having five sets of cutting lobes.

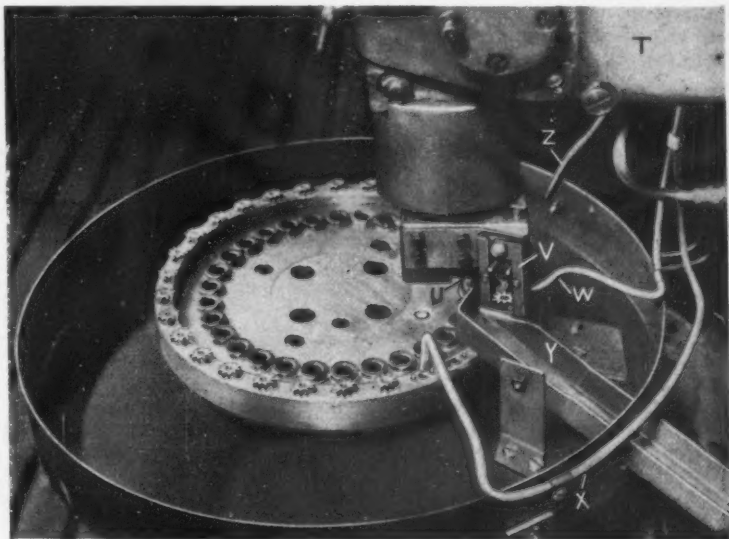
The Fellows machine is employed for normal gear shaping, as well as for the profiling operations, and is installed in a well-equipped gear-production section of the main machine shop. Other equipment in this section includes a Gleason bevel-gear generator which is used for a wide range of components, the smallest being a duralumin gear with 16 teeth of 50 D.P. In addition, there are two C.V.A. No. 2, and four Pfauter, hobbing machines, also six small hobbors—five by Gauthier and one

by Mikron. The five Gauthier machines are arranged in a group, and, since they work on an automatically-controlled cycle, are tended by one operator, whose duties consist principally of loading and unloading the workpieces. In some of the gears that are cut on these machines, a slot must be milled across one face after hobbing, in a certain relationship to the teeth. When the operator unloads these gears from the Gauthier machines, she transfers them to the indexing table of an adjacent special-purpose milling machine which has been developed and tooled-up by the Bell Punch Co., Ltd.

#### SPECIAL MILLING MACHINE WITH INDEXING TABLE

A close-up view of the milling machine table and cutter head is given in Fig. 9. The head has a vertically-disposed quill, to which a rise and fall motion is imparted by a cam, through a rack and pinion transmission system. Mounted on the end of a horizontal shaft, within the cover *T*, the cam can be replaced by other units if it is necessary to alter the rate of down-feed. The cam employed for the slit-milling operation provides a feed rate of approximately 6 in. per min. At the lower end of the quill there is housing for a horizontal cutter spindle, which is driven through bevel gearing at a speed of 500 r.p.m. The spindle carries a 1-in. diameter by 0.063 in. wide saw, and is arranged so that the saw is tangential to the pitch-circle of the work-station on the table.

Fig. 9. Close-up View of the Special Indexing-table Machine which has been Developed and Tooled-up by the Company for Milling a Slot in One Face of Small Gears. The Workpieces are Loaded by Hand, but are Unloaded Automatically, and are Blown by an Air-blast into a Chute which Directs them to a Receptacle at One Side



The circular table has 30 work-stations on its raised rim, and at each station there is a counter-bored hole and two dome-headed pins. Workpieces are loaded so that the boss on one side of each enters the hole, and diametrically-opposed tooth-spaces are engaged with the pins, to ensure that the slot is milled in the correct relationship to the teeth. The table is indexed by means of an air-operated pawl and ratchet mechanism, the pawl-actuating cylinder being connected to one of two valves on the far side of the cutter head. These valves are mounted on either side of the cam shaft, at the end remote from the feed-cam. A second cam serves to operate the valves, and the arrangement is such that the table is indexed through 12 deg. each time the quill of the cutter head is raised. In addition to the work-stations, there are 30 hardened steel bushes in the table, within the raised rim. Two stout pilot pins project downwards from the housing at the bottom of the quill, and enter two of the bushes as the quill descends, to locate the workpiece finally in relation to the cutter. In Fig. 9, one of the pilot pins is just visible at U.

Below the spindle housing at the lower end of the quill is mounted a spring-loaded pressure plate, which contacts the upper face of the workpiece as the quill moves downwards. This plate holds each workpiece securely in its seating during the cutting operations, and has a slot for the passage of the cutter. A bracket is secured to one side of the spindle housing, and carries two claws V, mounted on a common pivot. These claws are pulled together by a tension spring, until they contact stop pegs. The claws are of an L-shape, and at the lower end of each there is a tapered lug. As the quill descends, the claws pass over a slotted workpiece at the station adjacent to the cutting position.

It will be observed in Fig. 9 that there is a broad chamfer at either side of the rim of the work-table, and the workpieces project slightly over the chamfer-faces. In consequence, when the claws have passed over a workpiece, they can move inwards so that the tapered lugs are beneath the edges. When the quill is raised, the lugs engage the workpiece and lift it clear of the hole and pins in the work-table. As the quill approaches the limit of its upward movement, the second valve at the far end of the camshaft is tripped, and compressed air is directed to the pipes W and X. The pipe W terminates in a nozzle on the far side of the claws, and the blast of air from this nozzle blows the slotted workpiece from the claws into the chute Y, whereby it is delivered to a work-pan at the side of the machine column.

The end of the pipe X is flattened to form a

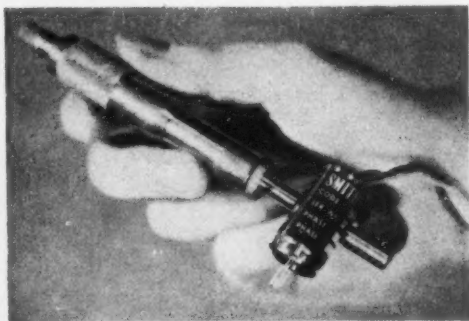
broad nozzle, which is located directly over one of the empty work-stations. Air from this nozzle serves to remove swarf and coolant in readiness for loading a fresh workpiece at the next position. A copious flow of soluble oil and water emulsion is directed continuously on to the cutter and work from the pipe Z.

With the equipment described, gears are slotted at a rate of 720 per hour, and it has been found that from 10,000 to 15,000 workpieces can be machined with each high-speed steel saw. When the teeth become blunt, the saws are discarded, rather than resharpened.

Further interesting equipment and methods that have been developed by the Bell Punch Co., Ltd., for the production of a wide range of pressings will be described in a further article, to be published shortly in MACHINERY.

### Smiths Size 7 Motor

The motor shown in the figure which is claimed to be one of the smallest of its type in the world, has an overall length of 1.6 in. and an outside diameter of 0.625 in. Of "potted" construction, it



Smiths Size 7 Motor for Small Servo Systems

incorporates non-corrodible laminations and has been introduced by Smiths Aircraft Instruments, Ltd., Cricklewood, London, N.W.2, for fitting to small servo systems, for example, for guided weapons.

A single-phase 26v. supply may be employed in conjunction with a 1.5 mf. tuning capacitor, or a two-phase 400 c.p.s. supply. One type can be operated directly from a pair of germanium transistors connected to the centre tapped control phase. The speed of the motor on no-load is 9,000 r.p.m., and the stalling torque, 8 grm-cm.

# Employment of the Blind in Industry

## *Some Examples and Results of Modern Training Methods*

Although it is commendable that in Britain a higher percentage of blind workers is engaged in open employment than in any other country, the extent to which they can be of service to the engineering industry is still not, perhaps, fully appreciated. They represent a potential labour force of some 14,000, which can, in suitable circumstances, afford a solution to many manpower problems, on the basis of full equality with workers of normal vision. The idea of employing blind factory-workers on this basis is not, of course, new, but it was only during the second world war that it came into effect on any significant scale. At that time, the labour shortage provided both incentive and opportunity, although, initially, the tasks performed by blind workers were rather elementary. Due to modern investigation and training methods, however, and an increasingly realistic outlook on the part of employers, the field of opportunity, for employer and blind employee alike, has been considerably extended.

Tribute must be paid, in this connection, to the excellent work of the Royal National Institute for the Blind, and the Ministry of Labour and National Service training centre at Letchworth, Herts., and as a result of these efforts, the Employment Service of the R.N.I.B. is able to place approximately 350 fully-trained blind workers in competitive employment annually. Of this number, the majority find work in various branches of engineering. If the full results are to be derived from such efforts, however, there must be a commensurate willingness on the part of employers, who have not already taken this step, to consider seriously the possibility of introducing blind workers into their factories. It is emphasized that the employment of a trained blind worker entails no additional financial or other obligations on the part of the employer, and that preferential treatment is neither expected nor desired. As a matter of principle, which is rigidly enforced, no blind worker is recommended to any prospective employer except on merit alone, and unless he or she can be of advantage to the firm concerned.

### CHARACTERISTICS

For a true appreciation of the working potentials of the blind, due consideration must be given to their psychological characteristics, and the pains-

taking care exercised by the above-mentioned organizations in selecting and training suitable subjects for specific duties, in accordance with individual temperament, aptitude, and circumstance. Great importance is attached to the necessity for compatibility of work and worker, as indeed it must also be with sighted workers, if maximum efficiency is to be achieved. Choice of the most suitable occupation and training are dependent, to a certain extent, on whether the subject was blind from birth or recently became blind, and whether blindness is total or only partial. In certain instances, those suffering from incipient blindness are also trained, in order that their working lives may continue with as little disorganization as possible during and after the transition period.

Given suitable training, the blind are, in many ways, peculiarly suited to skilled repetition work. For example, in order to compensate for the loss of sight, other faculties become highly developed, one of the most important of which is the sense of touch. Also developed are a keen sense of motion and relative position, or, as it is sometimes termed, "spatial perception." They move deliberately and methodically, and are thus readily able to adapt themselves to working in accordance with time-study principles. These attributes are of value for all forms of repetition work, whether it be inspection, assembly, or machine-operation. The highly sensitive touch of a blind inspector, coupled with his great powers of concentration, due to the absence of visual distractions, will often enable him to detect small imperfections which would not be noticed by a sighted person.

Again, freedom from visual distractions, coupled with the fact that the blind are always alert to the danger of accidental, hurtful contact, ensures that a blind machine-operator can tend his machine without likelihood of injury. For the same reason, special guards or other protective devices are seldom necessary, and in the few instances where they are required, they are usually found to be equally beneficial to the sighted. One type of routing-machine guard, currently in general use, was originally designed for the blind. Distraction and carelessness are the two main causes of industrial injury, and apply in a far lesser degree to the blind operator. It may be noted, indeed, that the accident rate among the blind is generally lower than for the sighted, and that no employer has yet

been called upon to pay an increased insurance premium in connection with a blind worker.

The light sensitive touch of the blind machine-operator, allied with acute hearing and freedom from distraction, all make for efficiency in the handling of a machine. Impending cutter breakdown is more readily detected, and this applies particularly when drilling small holes, so that with blind operators, drill-breakages occur less frequently.

One of the most outstanding characteristics of the blind worker, moreover, is that he has a very high working morale. This attribute stems from the fact that he is determined to prove to himself, and to all his acquaintances, that blindness is really not such a serious handicap that it cannot be overcome, and that he is perfectly capable of leading a normal useful working life, on terms of complete equality with others. Above all, he wishes to feel that he is doing something worth while.

Because of this frame of mind, the blind worker has a ceaseless urge to keep busy, and this urge, coupled with the absence of visual distractions, accounts for his exceptional powers of concentration. Since he finds fulfilment in his work, he has a happy disposition, and an enthusiasm that is communicated to those around him. His working efficiency is such that he can equal or sometimes exceed their output, and he thereby evokes their respect. From the latter, he gains a further stimulus, and they, in turn, are encouraged by his example. Because of this urge to attain independence and fulfilment, he has no wish to be

treated in any way differently from his colleagues. Indeed, anything appertaining to charity, sentiment, or special privileges is not only unwanted but psychologically undesirable.

#### TRAINING PROCEDURES

It is to the attainment of this healthy mental attitude, and to the selection and training of workers who are competent in every respect, that the efforts of the R.N.I.B. and the Government training centre at Letchworth are directed. The problems involved are essentially human, and, as such, are correspondingly individual and diversified. For example, in subjects who are blind from birth, the difficulty of illiteracy is not uncommon. Again, in training a blind person for inspection duties, it may be necessary to teach him or her the decimal system. In the case of a person who has only learnt to read and write in Braille, it may be desirable to give instruction in writing orthodox characters. An example would be an inspector, called upon to record the dimensions of components checked with the aid of a Braille micrometer. At the Letchworth training centre, in such instances, a working familiarity with conventional numerals is taught by means of characters shaped from wire and fixed to a board. The newly blind, on the other hand, are less likely to need tuition of this type.

Practical experience has shown that the most suitable subjects for employment in industry are those who have undergone a course of rehabilitation. Newly blind subjects, selected jointly by the R.N.I.B. and the Ministry of Labour and National Service, are accepted for such courses at two R.N.I.B. rehabilitation centres. Here, the subject is taught to adjust himself mentally and physically to blindness, so that the spirit of self-dependence



Fig. 1. Typical Group of Blind Trainees in the Assembly Section at the Ministry of Labour and National Service Centre at Letchworth. Bimanual Layouts are Employed

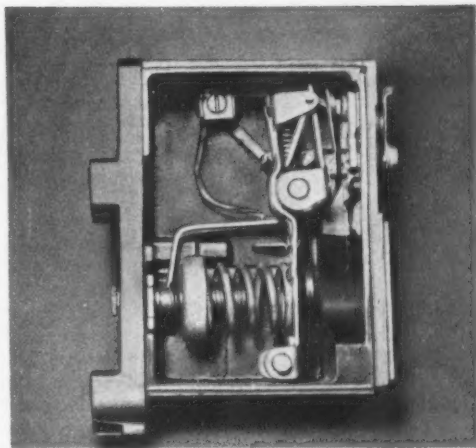
is restored, and he is able to lead a normal active life. He is made to realize that the handicaps of blindness can be largely overcome, and learns to perform all small personal tasks for himself. Classes in independent mobility teach him to stand and walk correctly, to estimate relative distances, and to form the habit of building-up a mental picture of his surroundings, so that he may move about freely and with confidence. During this course, which is of three months' duration, all, except those too illiterate to learn, are taught Braille or Moon.

On the basis of monthly interviews between the subject and the R.N.I.B. employment officer, and reports on progress and potentialities compiled by the principal of the centre, an assessment of the subject is built-up during his period of rehabilitation. Towards the end of the course, a final report is prepared, which makes a specific recommendation as to the most suitable type of vocational training for the individual concerned. The greatest care is exercised in arriving at an accurate evaluation of his potentialities, because, ultimately, the success of blind workers generally, depends on that of each individual.

On completion of the rehabilitation course, the final report is submitted to the Ministry of Labour and National Service, who make application on behalf of the subject, for his admission to an appropriate training centre. At the Letchworth centre, those selected for employment in the engineering industry undergo a two-months' course of basic industrial training. Here, every attempt is made to avoid anything resembling a "school-room" atmosphere, and to simulate factory conditions as closely as possible. Familiarity with the handling of machines is afforded by instruction and practice in drilling, milling, and capstan-lathe work, and inspection and assembly are also taught.

#### ASSEMBLY WORK

At the beginning of the course, those selected for training as machine operators are given instruction in assembly work, for one to two weeks. This period gives them the opportunity of settling down in their new surroundings, and acquiring a familiarity with their instructors, and engineering work generally. Training in assembly work is given in the section shown in Fig. 1, where a group of new trainees is seen. As may be observed, bi-manual set-ups, representative of modern industrial practice, are provided. Initially, the tasks set are of a simple nature, and the complexity and difficulty are progressively increased. Before the trainee can graduate from one task to another, he must attain an acceptable level of proficiency, in



**Fig. 2. This Complicated Relay-unit, for Hotpoint Electric Appliance Co., Ltd., illustrates the Type of Advanced Assembly Work Within the Capacity of the Blind**

accordance with industrial standards. A typical task consists of assembling roller thrust bearings, at the rate of 1 min. each.

Those selected for training in assembly work remain in the section throughout the full 2-month period, and once they have attained the necessary standard, are trained for specific duties with their future employers. Contact between trainee and prospective employer is established by the R.N.I.B. Employment Service, through their team of employment officers. In Fig. 2 is shown a complicated relay-unit, which illustrates the advanced type of assembly work that can be undertaken by a blind operator, given suitable training. The operator in question was trained for this duty at the Letchworth centre, for employment by the Hotpoint Electric Appliance Co., Ltd., Peterborough.

As may be observed, the unit incorporates a number of springs and linkages, of a complexity sufficient to present difficulties even to a sighted operator. The firm's stipulated time per assembly was  $3\frac{1}{2}$  min., whereas the blind operator was able to achieve a time of 3 min. This standard was attained by the use of a very simple fixture, designed at Letchworth, which would have been equally advantageous for a sighted operator. The particular unit mentioned has meanwhile become obsolete, and the operator has been transferred to other similar work for the same company. It is

stated by the firm that the training given at Letchworth was extremely useful, as it enabled the operator not only to assemble the original unit efficiently, but also to adapt himself readily to his new duties. This company, it may be noted, also employs a blind inspector.

#### MACHINE WORK

After completing their preliminary short period of assembly work, trainees selected for tuition as machine-operators are introduced to machine work, starting with simple drilling. The machine lines provided for the training of the blind are situated in the main machine-shop of the centre, and the equipment is throughout of standard type. It includes single- and multi-spindle drills, and Herbert, Ward, Murad and Modern capstan lathes, in order that the trainees may become thoroughly familiar with various makes and sizes of machines currently in use. The trainees are also given instruction on larger machines, available in an adjacent section, should they so desire.

Initial instruction on drilling is given on single-spindle machines, and after his first introduction to drilling, the trainee is transferred to the "peg-board" set-up shown in Fig. 3. This equipment is designed to provide an exercise that simulates a lengthy operation sequence, and to permit an assessment of the trainee's ability and his accept-

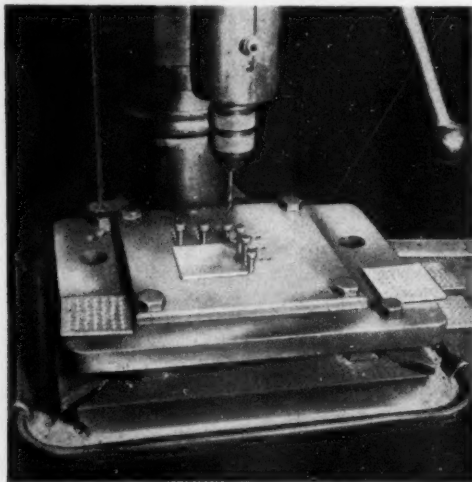


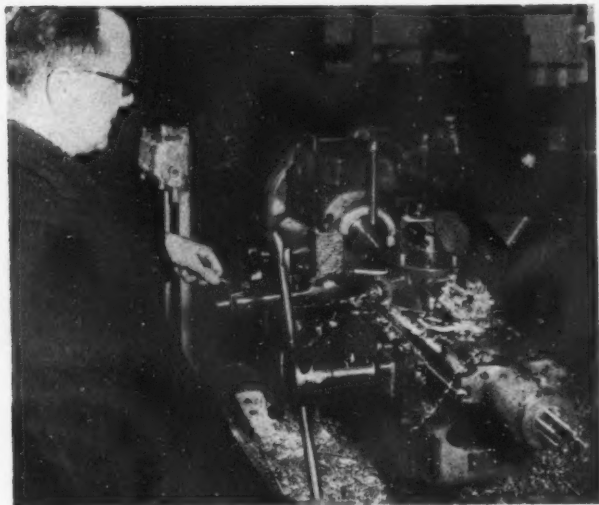
Fig. 3. This "Peg-board" Set-up on a Single-spindle Drill is Used to Familiarize the Blind Trainee with Length Operation Sequences, and to Assess his Acceptance of Machine Work



Fig. 4. On This 4-spindle Drill, a Blind Machine-operator is Seen Undergoing Training in the Use of a Typical Multi-station Fixture for Centre-drilling, Drilling, Chamfering and Tapping

ance of machine work. Mounted on the machine table, there is a drilled plate, in which a set of six pegs can be arranged in various alternative patterns. These pegs are used to locate a workpiece, comprising a square plate, by two adjacent edges, as seen. They are first arranged to locate the work for drilling the corners, and after each hole is drilled, the work is turned through 90 deg. When all four corners have been drilled, the pegs are repositioned, and four more holes are drilled in the same way. This procedure is continued until a pattern of holes, nominally equally spaced, occupies the entire area of the plate, and any misalignment is visually apparent to the instructor.

When he has attained the necessary standard at the drilling set-up described, the trainee is transferred to an Adcock & Shipley bench-type vertical milling machine, fitted with an indexing fixture. On this machine, for a period of approximately a week, he performs a series of exercises in milling squares, hexagons, slots and keyways. This is followed by a period of training on a 4-spindle drilling machine, shown in Fig. 4, which is equipped with a simple fixture. This fixture is designed to simulate the type commonly employed for locating work beneath each spindle in turn. In this instance, the work comprises a square steel plate, which is located between a pair of



**Fig. 5. First-stage Capstan-lathe Training is given on the Small Murad Machine here shown. A Range of Standard Machines Familiarizes the Trainee with Types in Current Use**

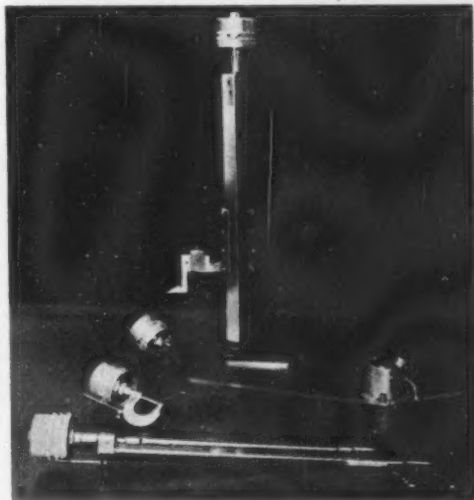
recessed parallel rails, and by a retractable stop at each station. Flat claws at the second and fourth stations serve to retain the work in the recesses. The sequence comprises centre-drilling, drilling, chamfering and tapping, the latter operation being performed with a standard attachment.

Training on the set-up described is followed by an introduction to lathe work, starting with the Murad capstan-lathe shown in Fig. 5. The operator here seen became blind as an adult, during his employment in the engineering industry, and after rehabilitation at one of the R.N.I.B. centres, was accepted for training at the Letchworth centre. His earlier engineering experience was an advantage, and he proved himself readily adaptable to machine work. The operation-sequence he is seen performing is that usually followed on first introduction to lathe work, and comprises feeding the bar to a stop; centre-drilling; drilling; turning with a roller-box tool; forming with a front cross-slide tool; and parting-off, with the rear tool. As in the course for assembly operators, the trainees are given work of progressively increasing difficulty, and as each becomes competent in handling a particular machine, he is transferred to another of a larger or more advanced type.

#### **BRAILLE INSTRUMENTS**

Trainee inspectors, also, are taught on a similar progressive basis, and their course includes tuition in the use of Braille measuring instruments. Examples of these instruments, shown in Fig. 6,

comprise a micrometer, depth-gauge, protractor, height-gauge, and vernier. As may be observed, each instrument is provided with a Braille-reading drum, which, except in the case of the protractor, operates on the screw micrometer principle. The height gauge and vernier are adjustable by 1 in. increments, by means of length-bars, and afford readings to 0.0002 in. The 1-in. micrometer and the depth-gauge give readings directly to 0.0002 in., and permit estimation to 0.0001 in. With the protractor, direct readings to 15 min. are obtained, and estimations can be made to 5 min. A typical exercise in the use of the micrometer consists of measuring and recording the various diameters of a stepped plug. A 6-in. vernier rule has recently been developed which permits measurement to an accuracy of 0.0025 in.



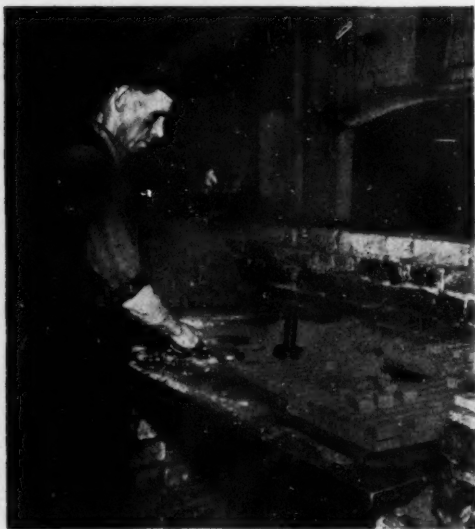
**Fig. 6. Group of Typical Braille Instruments, in Use of which Blind Inspectors are Trained. The Accuracy of these Units is Equivalent to that of Normal Measuring Instruments**

In order that the employer of a blind inspector need not be involved in any additional expense for the purchase of equipment of the type described, a special service is available. A 1-in. Braille micrometer is supplied to each operator through the "aids to employment scheme" of the Ministry of Labour and National Service, and other instruments in the range are loaned to the firm concerned by the R.N.I.B.

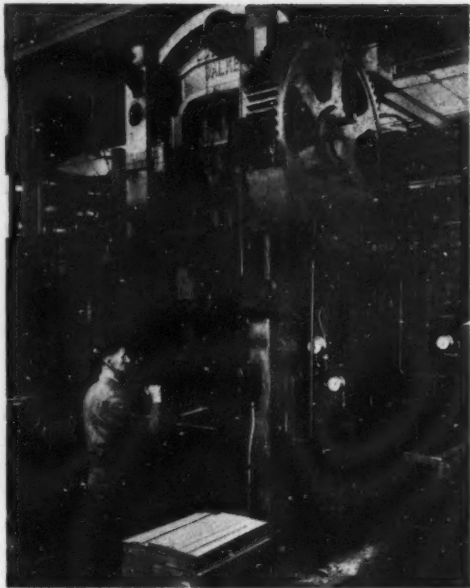
As evidence of the low accident rate among the blind, it may be mentioned that there has not been a single instance of serious injury to a blind trainee at the Letchworth centre, during the 9 years that it has been in operation, nor during the preceding five years when the blind were trained on the job by the R.N.I.B., whose success led to the setting up of the Letchworth centre.

#### PLACEMENT OF BLIND OPERATORS

As already indicated, contact between the trained blind operator and his prospective employer is established through the R.N.I.B. Employment Service, and their team of employment officers. Towards the end of their course at the Letchworth centre, the trainees' competence and speed of operation are assessed, and a progress report on each is sent to the responsible employment officer.



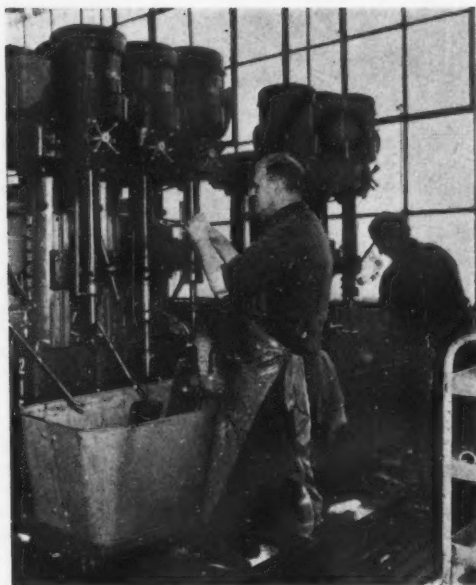
**Fig. 7. This Blind Worker is Employed on Core-making, at the Works of Gloucester Foundry, Ltd. All the Operators Shown in Fig. 7 to 11 Maintain the Full Rate**



**Fig. 8. Blind Operator on a 50-ton Press at Chatwood-Milner, Ltd. This Firm Also Employs a Blind Capstan Operator, who is Stated to be Exceptionally Capable**

On the basis of this information, the employment officer makes recommendations to the management of any engineering firm willing to engage a blind operator, as to the most suitable individual for a specific job.

Initially, the operator is engaged for a probationary period, during which the responsibility for establishing him in his work is that of a training officer. The latter augments the basic instruction given at Letchworth by specialized training in the firm's factory, including operation procedure and safety routine, and the time required for the new recruit to attain an average standard of proficiency is comparable to that required by a sighted trainee. Often, the training officer can suggest other work within the operator's capacity. No blind worker is allowed to remain on a task at which he is unable to make the full rate, and in such an unusual event, he is replaced and transferred to other duties at which he can maintain the required standard. Meanwhile, contact with employer and employee is maintained by the employment officer, in an advisory capacity, in order to ensure maximum mutual satisfaction.



**Fig. 9. Two Blind Operators, Working as a Team, Drilling Oil-holes in Rocker Castings at Tilling-Stevens, Ltd. Their Light, Sensitive, Touch Minimizes Breakages of the Long Drills**

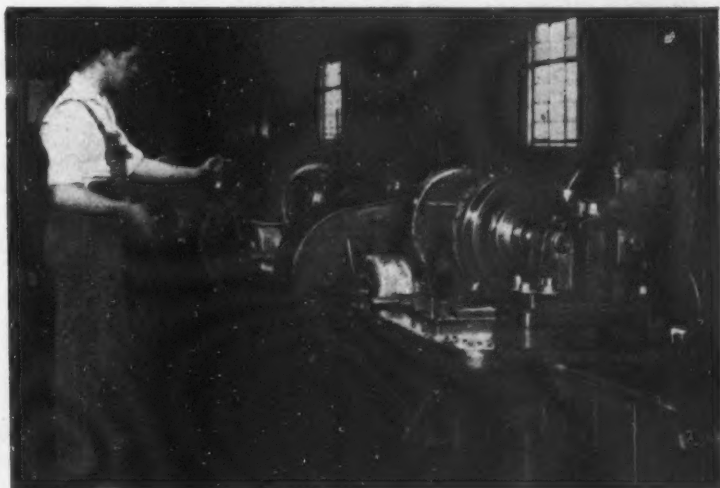
Since its inauguration in 1942, the R.N.I.B. Employment Service has successfully placed nearly 4,000 blind employees in industry and commerce. Their 15 employment officers are themselves either blind or partly blind, so that they are able to appreciate fully the capabilities and limitations of the blind trainees. There are three training officers who

operate in most industrial areas in the country, and are skilled engineers with wide industrial experience. This experience, and understanding of the problems of the blind, enable them to establish blind operators in their work, so that the requisite standard of proficiency is attained in the shortest time possible. In addition, the R.N.I.B. have recently appointed an investigation officer, whose duty it is to study other branches of industry in which the working potential of the blind could be utilized.

#### EXAMPLES

The fact that blindness is no handicap to the working efficiency of those selected and trained for specific industrial occupations, is well demonstrated by Fig. 7 to 11, in which are shown some typical blind operators and their work. In every instance, the operator is able to maintain the full rate, and the diversity of these examples affords an indication of the wide range of duties that the blind can undertake. In Fig. 7 is seen a blind worker employed on core-making at Gloucester Foundry, Ltd., where his light touch and methodical movements enable him to handle the fragile cores without breakage, and to produce clean, accurate work.

Both light and heavy press work come within the scope of the blind, and in Fig. 8 is seen the operator of a 50-ton crank-press, at the works of Chatwood-Milner, Ltd. As may be observed, the machine and guard are of standard type. This company also employs a blind capstan-operator, who is considered exceptionally capable. When blind operators are employed on small unguarded



**Fig. 10. This Blind Operator, who has Been Employed for Several Years by the Perry Chain Co., Ltd., Tends a Group of Rotary-head Milling Machines**

**Fig. 11. The Exacting Work of Fault-finding in Radio Circuits is Efficiently Performed, with the Aid of an Avo Instrument with a Braille Scale, by this Blind Employee at the Works of Bush Radio, Ltd.**

hand-presses, risk of finger-injuries is readily eliminated by limiting the clearance beneath the punch. This simple precaution, which, incidentally, also represents good press-shop practice, is equally desirable for sighted operators.

A "team" of two blind operators, employed by Tilling-Stevens, Ltd., who are associated with the Rootes Group, is seen in Fig. 9. These men are engaged on drilling the oil-holes in rocker-arm castings, necessitating the use of long drills. For this work, the light, sensitive touch, characteristic of the blind, is of value in the avoidance of breakages. This company, it may be noted, has, over a period, employed a considerable number of blind operators. In Fig. 10 is seen an operator who tends a group of rotary-head milling machines at the works of the Perry Chain Co., Ltd., where he has been employed for a number of years.

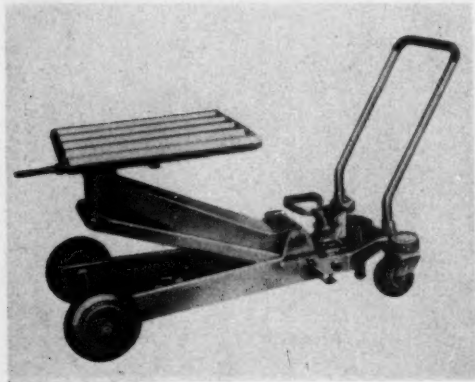
An indication that those who are more technically inclined can also find suitable employment



in industry, is afforded by the example in Fig. 11. This young man is employed on the exacting task of fault-finding in radio-receiver circuits at the works of Bush Radio, Ltd., and is believed to be the only blind person so engaged in the British radio industry. He is seen using an Avo electrical measuring instrument, fitted with a Braille scale. Originally employed by Decca, Ltd., he has passed a number of City & Guilds examinations, and was recently appointed to the staff of his present firm.

### Hunter Universal Truck for Dies

Developed primarily to facilitate the mounting and removal of dies, universal trucks of the type



shown in the figure are being marketed by G. Hunter (London), Ltd., 80 Fenchurch Street, London, E.C.3, with capacities of 500, 1,100, and 2,200 lb. The low chassis is carried on ball bearing mounted wheels with solid rubber tyres, two of which have full castor action to ensure good manoeuvrability. A foot-operated lever provides for the hydraulic lift of the arm, and a self-locking release valve, which is also foot controlled, gives a controlled lowering speed. The lowered height is 9½ in., and the normal effective lift, 27½ in., but extensions to give higher lifts can be provided.

A roller platform, carried on the arm, can be swivelled through 360 deg., and moved laterally through a distance of 6 in. to either side. There is a lock for the swivel motion, with the platform in the central position, and the rollers can also be locked when tools are being transported.

**This Hunter Universal Truck which has been Developed for Handling Dies, has a Roller Platform and Hydraulic Lift for the Swivelling Arm**

## Superston Bronze

An outcome of prolonged investigations in connection with materials for marine propellers was the introduction, several years ago, by J. Stone and Co. (Charlton), Ltd., Woolwich Road, London, S.E.7, of a copper-base alloy containing a high percentage of manganese and possessing the qualities of toughness, high tensile strength, good castability, and resistance to corrosion. Known as Novoston, the alloy has been used with success in marine engineering for more than five years, and during this time, some 3,000 tons has been cast in the form of propellers.

Further research by the company in this field led to the development of additional copper-base alloys, known collectively as Superston, which have been introduced into many branches of industry during the past two years. Each alloy in the group contains the same basic constituents which are varied in proportion to obtain the desired characteristics for different applications. These alloys contain 11-13 per cent manganese, 7-9 per cent aluminium, 2-4 per cent iron, and 1.5-5 per cent nickel, and the melting temperature ranges between 950 and 990 deg. C., as compared with 1,060 to 1,080 deg. C. for aluminium bronze. Tensile strength of Superston alloys varies from 45-55 tons per sq. in., and in this respect they are comparable with aluminium bronzes and high tensile bronzes. Superston-40, the most widely used alloy in the group, has an ultimate tensile strength of 45 tons per sq. in., a proof stress in excess of 20 tons per sq. in., and an elongation value of 30-35 per cent, in the "as cast" condition. Where greater tensile strength is needed, Superston-60 can be employed, but this alloy is less ductile. Superston-44, another alloy in the range, finds application where high strength and improved creep characteristics at elevated temperatures are required, and it may be noted that at a temperature of 450 deg. C. the short time tensile strength is 25 tons per sq. in.

In comparing high-strength alloys, it is useful to consider the proof stress. Superston-40 has a much higher proof stress than aluminium bronze of corresponding tensile strength, and the proof stress values obtainable for Superston-60 are much higher than are normally obtainable for aluminium bronzes, being of the same order as those of all-beta high-tensile bronzes. The latter materials find very limited application due to their susceptibility to stress corrosion, whereas Superston-60 is not prone to such effects. Although high-tensile bronzes

might have proof-stress and tensile-strength values of the same order as those of Superston alloys, their resistance to corrosion fatigue is poor.

A feature common to all Superston alloys is the facility with which they can be cast, although, as with all high strength bronzes, care must be exercised in the selection of running and feeding methods, to avoid unsoundness. Castings of thin section, it is claimed, can be made from these alloys, and savings in weight, cost, and machining time can thus be obtained. The material can be cast in sand, shell, or semi-permanent moulds. Centrifugal and gravity die castings can also be made, and small parts can be produced by precision casting techniques. In the accompanying illustration are shown two sand castings, in Superston, for a dynamometer. The casing in the foreground weighs 99 lb. and the other component—a rotor—138 lb. In this instance, Superston was specified because of its resistance to erosion and cavitation attack from liquid flow.



Two Dynamometer Castings in Superston Produced by J. Stone & Co. (Charlton), Ltd. The Rotor, in the Background, Weighs 138 lb. and the casing, in the Foreground, 99 lb.

**RECOMMENDATIONS FOR MACHINING**

The machining of Superston has been the subject of considerable investigation by J. Stone & Co. and other firms, and experience so far gained suggests that the difficulties encountered are less than those experienced when machining stainless steel or aluminium bronze. Superston can be turned successfully with either high-speed steel or cemented-carbide tools. For roughing cuts, a flat topped tool is recommended, but for finishing passes, a side top rake of 3 deg. should be provided. For roughing operations, the depth of cut may range up to 0.250 in. with a feed of 0.010 in. per rev., and finishing cuts should be of the order of 0.005 to 0.010 in. with a feed of 0.005 in. During a series of tests, Superston was turned at 230 ft. per min., using high-speed steel roughing tools, and the life between regrinds was 1 hour. This period was extended to 8 hours when the speed was reduced to 130 ft. per min. Finishing cuts were taken at 230 and 160 ft. per min., and tool lives of 1 hour and 8 hours, respectively, were obtained.

When a tungsten carbide tipped tool was used for rough turning at 525 ft. per min., the edge was dulled after 1 hour. By reducing the cutting speed to 290 ft. per min., an eightfold increase in life was again obtained. There was a similar extension of tool life when the cutting speed for finishing passes was changed from 820 to 490 ft. per cent min.

For screw cutting, tools with a 3-6 deg. top rake have proved satisfactory. High-speed steel chasers can be used for thread finishing. During turning and screw cutting operations, a copious flow of soluble oil coolant should be directed on to the tool and workpiece.

Drills for Superston alloys should preferably have a helix angle of 30 deg., and, in order to avoid binding, they may be relieved by approximately 0.002 in. at a distance of about 0.375 in. back from the leading full diameter. The use of soluble oil coolant is again recommended. Good results have been obtained when using high speed abrasive discs for cutting Superston bars and sections, and plates up to 1 in. thick can be cut with friction-type band-saws.

**PLASTIC WORKING PROPERTIES**

The hot working characteristics are such that the material can be supplied in the form of forgings; stampings; extruded rod, bar and tube; rolled rod and bar; and rolled plate and sheet. Despite the tendency of Superston to harden rapidly during cold working processes, it is possible to draw rod, wire, and tube in this condition, also

to roll sheet. Mechanical properties of the material can be varied by careful heat treatment. In a work-hardened condition, Superston alloys may give tensile readings as high as 70 tons per sq. in. A figure of 55 tons, it is claimed, can be obtained without excessive loss of ductility. Superston can be rolled to thicknesses of about 0.030 in. or less without difficulty, and, if required, may be produced in tubular form with walls that are of very thin section.

By carefully controlled heat treatment, the hardness of Superston-40 may be increased to 350 Brinell, and advantage has been taken of this characteristic to produce a range of British Standard safety hand tools, from forgings or castings, which may be employed in locations where safety regulations demand the use of non-sparking materials. Hammers, chisels, and wrenches, it is stated, do not chip or spall in use, and during periodical reconditioning by grinding, tools may be raised to a temperature in excess of 250 deg. C. before appreciable softening of the material takes place.

Superston alloys can be welded with rods of the type specified for aluminium bronze, but a special rod with a core of Superston wire is available. Metallic arc welding with flux coated rods is generally employed for Superston, but sound welded joints can also be obtained by means of the argon arc process. Thin sheet can be spot welded, and the alloys can be brazed or silver soldered, if desired.

The extent to which electro-chemical corrosion can occur when Superston and other metals are in mutual contact has been thoroughly investigated, and, from the results obtained, it may be concluded that the alloys do not differ from other bronzes in this respect. There is noteworthy resistance to various forms of chemical attack, and in one test the alloy was exposed to concentrated sulphuric acid at a temperature close to the boiling point. Under these conditions, the rate of penetration into the metal was only 0.003 in. per year, which is comparable with result obtained when Hastelloy D—an alloy containing 80 per cent nickel—was similarly tested.

It is stated that the use of Superston in industry, generally, is steadily expanding, and it is already being produced by licencees in this country and overseas. For example Bull's Metal and Marine, in Scotland, are producing turbine runners and other components for hydro-electric projects. In the U.S.A., the Superston Corporation, Inc., has been formed to market Superston products made by the National Division of the American Brakeshoe Co. and Ampco Metals, Inc., both of whom are making the alloys under licence.

## Additions to the Range of Keighley Grinders

Keighley Grinders (Machine Tools), Ltd., a subsidiary of the Newall Engineering Co. Ltd., Peterborough, have recently added three new machines to their well-known range, namely the KFG angle wheelhead grinder, the type 6L cylindrical grinder, and the KLGG precision grinder for gauges and other workpieces on which a very high degree of surface finish is required.

The type KLGG grinder, which is illustrated in Fig. 1, incorporates a number of interesting design features, which have been introduced principally to reduce vibration. A rigid construction has been ensured for the vee and flat table guideways by incorporating a Y-shaped rib centrally in the bed, and maximum stability has been achieved by wide spacing of the guideways and careful proportioning of the depths of the main and swivel tables

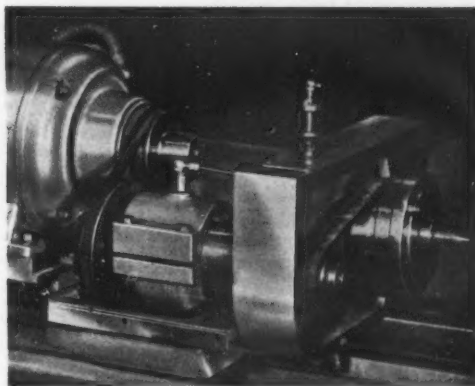


Fig. 2. Close-up View of the Workhead on the Keighley KLGG Grinder

in relation to the machine centre height, which is  $3\frac{3}{4}$  in.

Particular attention has been paid to the construction of the dead-centre workhead which comprises, in effect, four separate units fastened to the table and connected by belts as seen in Fig. 2. The main work-head casting carries the dead centre spindle only, and the driving plate and layshaft are mounted in separate castings, with the D.C. driving motor bolted to the table at the rear. A V-belt is employed for the drive from the motor, and the final transmission is by flat belt. Adequate adjustment for belt tension is provided without the use of jockey pulleys, and spindle speeds from 20 to 396 r.p.m. are available, the direct current supply being obtained from a static metal rectifier.

The design of the grinding wheel-head also ensures vibrationless operation, together with sensitive adjustment and positive positioning. Self-adjusting

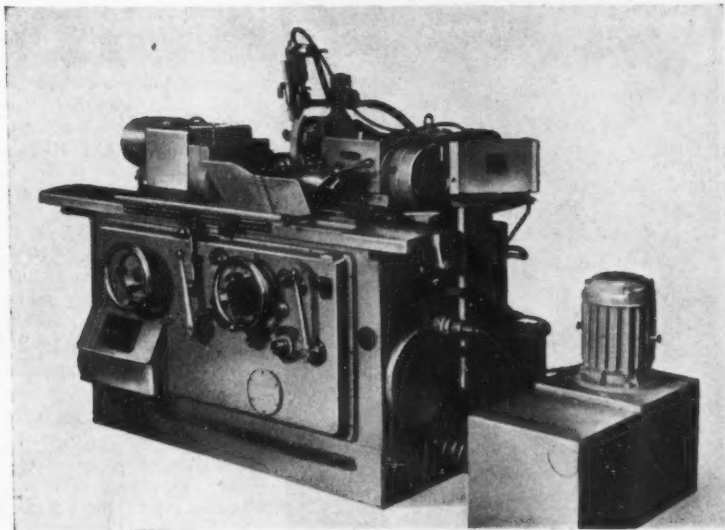


Fig. 1. Keighley Type KLGG High-precision Gauge Grinder of  $3\frac{1}{4}$ -in. Centre Height

bearings, comprising centrifugal cast-iron shells with a thin layer of white metal, are provided for the Nitralloy steel wheel spindle, and lubrication is effected by oil ring from a sump. Drive from the motor to the spindle is taken through a flat belt. Automatic lubrication is provided for the wheel-head slideways, and a hydraulic backlash eliminator is incorporated.

It is stated that the design of the machine is such as to balance out any expansion of the various units caused by temperature change, so that, under normal conditions, grinding to a high degree of precision can be carried out within 15 minutes of starting from cold. The machine is guaranteed to grind externally to a surface finish of 1 micro-inch, providing that normal care is taken with regard to such factors as stock removal, and condition of the centre holes. Components have been produced, it is stated, with a surface finish of 0.4 micro-inch, using a 60-grit aluminium oxide wheel. This type KLGG machine can be supplied in grinding length capacities of 9 and 18 in.

Fig. 3 shows the type KFG angle head grinder for heavy-duty plunge-cut and face grinding, at one setting. Based on the Newall-Keighley type L cylindrical grinder, this machine has a swing capacity of 12 in. and can be supplied to accommodate 24, 36, 48, 60, or 72 in. between centres. An intermediate slide is incorporated to position

the grinding spindle at 45 deg. to the work, and the feed is applied at 90 deg. to the direction of table traverse. According to requirements, provision can be made for either an intermittent pick feed from 0.0002 to 0.001 in., or intermittent plunge feed from 0.0001 to 0.001 in. Rapid travel through a distance of 2 in. is provided for the wheel-head, and a feed rate suitable for dressing can be obtained by adjusting a hydraulic control valve.

The third new machine, namely the type 6L cylindrical grinder of 3½ in. centre height, can be supplied with a length grinding capacity of either 18 or 24 in. While essentially a plain grinder, this type 6L machine can be used for grinding tapers by swivelling the work table, and equipment is available whereby concave and convex radii, angles and shoulders can be ground. When equipped with a live and dead centre work-head, the machine can be fitted with a self-contained internal grinding head and a selection of spindles covering a speed range from 15,000 to 30,000 r.p.m. Other equipment available includes a device for making compensation for wheel wear, so that the wheel can be dressed and the grinding operation resumed without the need for re-setting the size control.

In connection with the introduction of these new machines it may be noted that the design of the hydraulic control systems of all Keighley cylindrical and standard universal grinders has now been rationalized, so that component parts and sub-assemblies are interchangeable, and maintenance has therefore been facilitated.

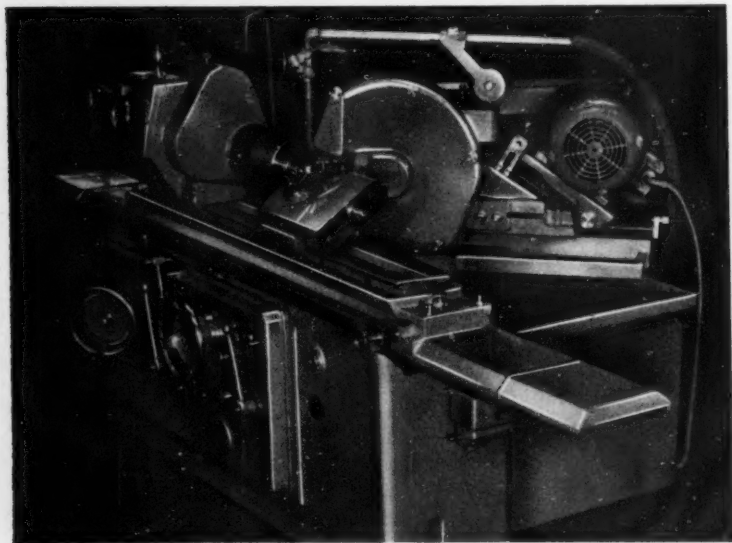


Fig. 3. Type KFG Heavy-duty Angle Head Grinder Introduced by Keighley Grinders (Machine Tools), Ltd.

**PRODUCTION OF DOMESTIC SEWING MACHINES**—During the months of December, November and October last year, 10,600, 13,700 and 12,800 domestic sewing machines were produced in this country for the home market. For the whole of 1957, the average monthly output for the home market was 11,400, and the corresponding figure for 1956 was 9,500.

# The Analysis of Hobbing Machine Periodic Error Diagrams

By A. FISHER, F.I.M., A.M.I.Mech.E.

A well-established procedure<sup>1</sup> is followed for recording those periodic errors in table motion which are likely to produce inaccuracies on gears cut on hobbing machines. It consists of recording, on a smoked glass plate located on the rotating table of the machine, interrupted or notched traces made by "kicking" diamond points, electromagnetically operated from precisely notched disc-shaped contact makers, accurately mounted on the shafts being checked.

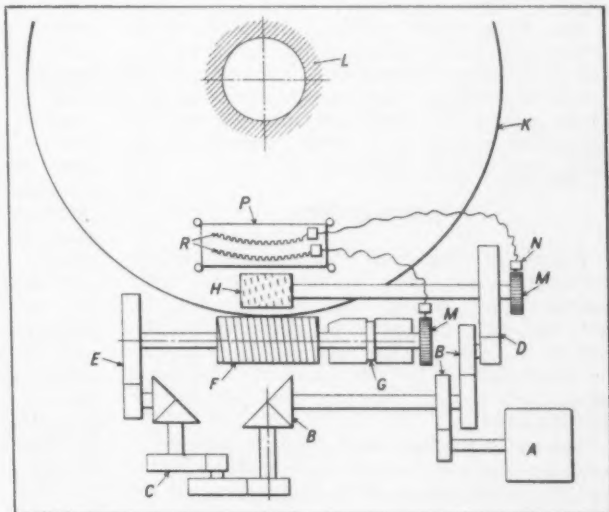
Usually two traces are made simultaneously, one from the main dividing wormshaft and one from the hobshaft, these shafts being geared together—through the gears in the machine, including change gears—to run at a low speed ratio such as 4:5, so that different integral numbers of revolutions of the two shafts are completed simultaneously, twice if possible, in the length of the smoked glass trace. The traces are thus continued over at least eight revolutions of the wormshaft and ten of the hobshaft. If time and staff permit, it is worthwhile to extend the recording over 16 revolutions of the wormshaft, so that 16 pitches of the main dividing wormwheel are covered and the identifica-

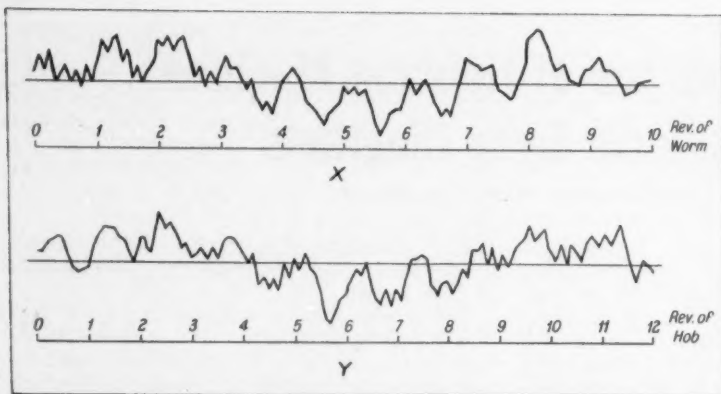
tion of medium-length undulations or pitch errors is facilitated. Tests are made for both directions of table motion.

The recorded traces are measured on a suitable travelling-head microscope, and the variations from regularity in the distances between the interruptions are plotted on separate graphs, one for each shaft. These variations represent the errors in motion between the table and the shafts on which the notched discs have been mounted, and on the graphs there is generally some noticeable periodicity in the variations, which appears as more or less mutilated undulations of a sinusoidal basic type. Since the kinematic connection between the table and two shafts being checked consists of rotating elements, this periodicity is only to be expected, and the analysis of the records or graphs consists in identifying and relating the undulations with the corresponding rotating elements in the gear circuits between the table and the shafts. Fig. 1 is a simplified kinematic diagram of a hobbing machine rigged up for the test. Fig. 2 shows a typical pair of graphs (the

<sup>1</sup>All references at end of article.

Fig. 1. Kinematic Diagram of Hobbing Machine Motion Test Rig-up. A—Driving Motor. B—Intermediate Gears. C—Indexing Change Gears. D—Hob Driving Gears (High Ratio According to B.S. 1498: 1954). E—Worm Driving Gears (High Ratio According to B.S. 1498: 1954). F—Main Dividing Worm. G—Worm Thrust Collar. H—Hob. K—Main Dividing Wormwheel. L—Wormwheel Shaft Location. M—Notched Discs. N—Contact Maker. P—Smoked Glass Plate. R—Traces





**Fig. 2. Typical Graphs of Hobbing Machine Table Motion Errors.**  
**X—Wormshaft-to-table Error Graph.**  
**Y—Hobshaft-to-table Error Graph**

worm-to-hob speed ratio employed being 5 to 6).

When plotted on squared paper, the two error graphs are usually made of equal length and divided longitudinally, the wormshaft graph into eight, and the hobshaft graph into ten parts (or according to the speed ratio selected), each part representing one revolution of the respective shaft. On each graph, corresponding ordinates of the sections covering separate revolutions are then added and averaged, to obtain the "average" periodic error for the frequency concerned. These "average" curves are generally regarded, perhaps not always obviously, as representative also of the "cyclic" errors for the two shaft frequencies. (Cyclic error is defined by B.S. 2519:1954 as "an error occurring during each revolution of the element under consideration.")

The foregoing is merely a summary of the process commonly used, and the full description can be found in reference (1). The object of this article is to discuss the question of the analysis of the graphs, after they have been obtained from recordings made in the manner outlined on non-creep type hobbing machines.

#### SOURCES OF ERROR

It will be seen from Fig. 1 (which is diagrammatic only, many of the additional intermediate gears having been omitted) that the only elements involved in the wormshaft-to-table motion in such machines are: (a) the wormshaft locating faces; (b) the worm itself; (c) the wormwheel itself; and (d) the wormwheel shaft location arrangements.

When a wormshaft error graph is obtained it may show an undulation at wormshaft frequency and/or undulations at other frequencies. If the former is present, the causative error(s) may be:—

(1) an error in the worm thrust faces; (2) a worm eccentricity error; (3) a worm pitch or lead error; (4) a worm thread profile error; and (5) a worm-wheel tooth profile error.

If the wormshaft error graph shows undulations at lower-than-worm frequencies, they almost invariably indicate the presence of pitch errors in the wormwheel, resulting from errors of motion during the cutting of its teeth. It is unlikely that extraneous random errors will cause low-frequency recurring undulations. If the wormshaft error graph shows undulations at twice the wormshaft frequency, they indicate a possible ovality of the worm, waves on the lead or on the profiles, or a double hump on one of the thrust faces working against a single hump on the other.

The elements involved in the hobshaft-to-table motion include *a*, *b*, *c* and *d* above, plus all the many gears in the complete circuit from hobshaft to table, which, in large machines, may number 40 or 50. It might therefore be expected that the hobshaft error graph would be much more complex and show greater amplitude of error than the worm graph. Such a result is often obtained, but occasionally there is very little difference in complexity and sometimes the wormshaft error graph shows the greater amplitude. There is, however, no general rule, since many disconnected factors enter into this relationship.

In addition to the sources producing regular periodic errors, which appear on the graphs as undulations, there are the usual sources of random errors, always present to some extent whenever measurements are made. It should be noted however that the random errors of table motion are of two types; firstly, there are errors deriving from actually existing irregular dimensional errors in the wormwheel tooth pitching, which may be termed "internal" random errors, and which it is desired

to record as far as is possible within the limits of the length of the trace. Secondly, there are errors arising from, or generated accidentally in, the recording and measuring processes, as a result of vibration, temperature changes, frictional slip or creep, or observational irregularities of any kind. The latter are here termed "extraneous" random errors, and care should be taken to avoid them, as being foreign to the purpose of the tests.

#### THE "MAKE-UP" OF THE ERROR GRAPHS

The error graph at wormshaft frequency will probably consist of a combination of undulations arising from the several possible sources mentioned above. It may comprise: (a) a portion of a "long-wave" component from medium-arc pitch errors (a few pitches long) in the wormwheel; (b) a component at wormshaft frequency due to worm thrust-face errors; (c) a component at wormshaft frequency but probably at a different phase position, due to profile errors in the wormwheel; and (d) third and fourth components at wormshaft frequency due to errors in worm lead, eccentricity, or profile.

The (b), (c), and (d) components set out above will be superimposed on (a), possibly all at different phase positions, and may thus affect the amplitude but not the number of peaks in the curve, since the wavelengths are identical and all the waves combine into one single sine type of curve of the same period, as shown in Fig. 3. Superimposed on all these curves will be the usual random errors, internally or externally originated.

Typical examples of table motion error graphs are to be seen in the articles "Accuracy in a 72-in. hobbing machine," *Engineering*, August 15, 1952<sup>2</sup>, and "Helical gears cut on solid table machines," *The Engineer*, April 22, 1949<sup>3</sup>, also in "Gear Hobbing and Shaving" by A. Sykes, B.Sc., M.I.M.E., 1956<sup>4</sup>.

Some of these errors may be extremely small in themselves before the phasing effects combine to reduce (or increase) the total amplitude. In Grade A machines (B.S.1498, 1954), for example, in the manufacture of which great care is taken, the total amplitude of (a) over the length of the record may be three or four ten-thousandths (in.); those of (b), (c) and (d) one or two ten-thousandths each; and the random errors of the same order. The final total amplitude may thus be about seven or eight ten-thousandths after phasing, and the overlapping effects of the hob cuts on a test gear may reduce this figure to the five or six ten-thousandths (in.) which are allowed according to B.S.1498.

As previously stated, the wormshaft-to-table

motion in a non-creep machine contains no element of error due to the gear pair driving the worm or of any other gear pair than the worm and worm-wheel. The different components at wormshaft frequency, however, cannot easily be identified with their separate sources from examination of the error graph alone. If, for some reason, such identification is required, other methods must be used. For example, the end movement of the wormshaft may be measured by means of a clock indicator registering on a ball placed in the end centre hole, to show the magnitude of the combined thrust face error for the direction concerned.

The inspection reports of the separate components may, of course, assist in the separation problem, but if several component errors are combining, these reports may not provide the complete solution. Further, it is impossible to determine from any inspection report of the wormwheel what its effective profile errors are. An examination of the profile on the central transverse section gives no information about possible errors on other sections, which are equally—or perhaps more—likely to produce errors in motion.

It is unnecessary, however, to attempt such separate identification if the "average" error form closely approximates a sine-curve, since one correction will reduce the net effect of all errors of the same period, whether it is made by adjusting the thrust faces of the worm, by an eccentric setting of the wormshaft driving gear, by a rotation of this gear on the wormshaft, by a rotation of the worm on its shaft, should it be of the sleeve type, or by an endwise movement of the worm relative to the wormwheel.

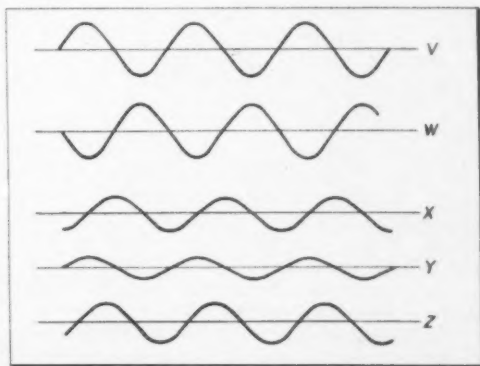


Fig. 3. Combination of Separate Errors into One Resultant, at Same Frequency. V, W, X and Y, Errors in Different Components; Z, Resultant Error in Motion

## INTERPRETING THE ERROR GRAPH

Interpretation of the wormshaft-to-table error graph requires firstly the "abstraction" of the "average" error at wormshaft frequency as explained in reference (1). When this "average" error is obtained, it is completely subtracted (*i.e.* for every revolution) from the original graph, leaving a curve containing only the wormwheel periodic pitch errors, the internal and extraneous random errors, and possibly a portion of a long-wave undulation indicating a cumulative type of pitch error which might be identifiable with the corresponding pitch variations shown on the separate inspection report for the wormwheel. It might, in fact, be considered useful to select, in the first place, such an identifiable portion of the wormwheel for the purpose of this test, and so provide an additional opportunity to check the accuracy of the results.

Any medium wavelength undulation of two to four pitches in length, if regular or recurring, is likely to be the "ghost" of a worm cyclic error in some previous machine on which the parent or grandparent wormwheel was cut. (The modern use of large numbers of teeth for dividing wormwheels explains the probable extension over, say, two to four pitches.) The effects of these master wheel errors can be transmitted to the third and fourth generations, and one faulty master wheel, if used for the production of other master wheels, might cause scores or even hundreds of service gears to contain the same or a derived fault and emit family noise characteristics.

By a process of continued abstraction and subtraction of the "average" errors at the different indicated frequencies, from the plotted original graph, the remaining errors may be separated one by one and checked against their respective frequencies and against the numbers of teeth in the previous master wheels, until only the various random errors are left. Details of this continued subtraction method were described in an article<sup>5</sup> "Analysis of Gear Tooth Undulation Records," by P. M. Gilet, of the Commonwealth National Standards Laboratory, in *Engineering*, September 21, 1951. It is applicable to both wormshaft and hobshaft-to-table motion error graphs, and is, in fact, generally known and used in hobbing machine inspection practice also.

The average error curve at wormshaft frequency sometimes appears as a double-peaked curve, with one peak larger than the other. It has already been explained that such a form cannot be the result of different phasing in respect of two simple sinusoidal errors of equal period as these would combine into one simple sine-curve at the same

frequency. Possible causes are (a) on ovality of the worm itself; (b) a wave type of error in the worm head; (c) waves on the worm and wormwheel profiles; and (d) multiple "humping" on the worm thrust faces. It is also possible that it may arise from a combination of the simple sine-curve resultant of various worm errors with a simple sine-curve error at twice the frequency of the worm, arising from (a), (b), (c) or (d).

Fig. 4 shows how a combination of two sine-curve errors, one at wormshaft frequency and one at twice this frequency, can produce a double-peaked curve for every revolution of the worm. What is, perhaps, a slight difficulty in standard nomenclature is thus introduced, for while an error in motion of this type might, without objection, be described as a "periodic" error in motion at wormshaft frequency, one can understand a momentary hesitation in applying the usual short term "worm cyclic error" to an effect which includes the result of an error at a different frequency from that of the worm. However, the error repeats itself "each revolution of the element under consideration" (*i.e.*, the worm) as required by B.S. 2519 for qualification as cyclic, so that the matter is apparently regularized. The fully descriptive term would be "cyclic error in worm-to-table motion at worm frequency."

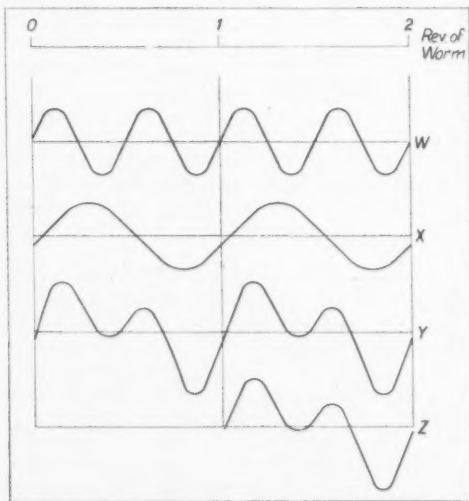


Fig. 4. Double-peaked Curve of Error at Worm Frequency. W—Component at Twice Worm Frequency. X—Component at Worm Frequency. Y—Combined Error at Worm Frequency. Z—“Average” Error at Worm Frequency

It is a point to be noted that a continuous curve of one regular form—a simple repeated sine-wave—can represent the occurrence of different cyclic errors at different frequencies.

To ensure that the hobshaft-to-table error graph shall be capable of yielding the maximum amount of information conveniently, it is essential to consider carefully, before the machine is set up for test, the question of the best speed ratio to use between the hob and the wormshaft. When these two shafts are selected for the motion test, which is nearly always the case, there might seem, at first sight, to be no need to adopt any other ratio than unity since: (1) the worm-to-table error would still be unique, that is, it would contain errors from no other gear than the worm and the worm-wheel; (2) the magnitude and form of the worm-to-table error would still be definitely and unambiguously determined by the test and exhibited on the derived graph; (3) the average error at worm frequency would still be easily obtainable from both graphs by adding and averaging ordinates; and (4) the average worm error would then be more easily and more accurately abstracted from the hob-to-table error graph, because the square-cornered "kicks" on the two records would occur practically simultaneously throughout the whole length of the records, and the points on the graphs would lie on the same ordinates. Thus, there would be no possibility of the average wormshaft error, as derived from the worm error graph, being influenced by components at the hob frequency.

However, if this "pure" average worm error (i.e., from the worm-to-table error graph) were subtracted from the hob-to-table graph, and the average error at hobshaft frequency (equal here to the wormshaft frequency) then abstracted, this average error would contain both the error in the wormshaft driving gear and that in the hobshaft driving gear, and it would be difficult to separate the two for correction determinations. For this reason, it is the practice to adopt a speed ratio somewhat different from unity.

In deciding on the exact ratio, care should be taken to avoid any inconvenient coincidence with the ratios of the wormshaft and hobshaft driving gears. For example, if these ratios were 1 to 5 and 1 to 4 respectively, a worm-to-hob test speed ratio of 4 to 5 should not be used, as this would cause the worm and hob driving shafts to run at the same speeds during the test and their respective errors could not be fully separated on the graphs. To avoid this condition, the requirement is that the integral numbers of revolutions of any important (i.e., comparatively slow-speed) shafts completed simultaneously in the length of the record, should be different.

When these points have been covered, and both the wormshaft-to-table and the hobshaft-to-table error graphs have been plotted, the first thing to be done is to abstract and compare the average error curves at wormshaft frequency from both graphs. Any difference between the two average error curves represents the error in the driving gear on the end of the wormshaft, and the effect of rotating this gear on its shaft for correction by phase differentiation can be considered. (Good examples of difference in average worm error abstracted from worm- and hob-error graphs are seen in references (2) and (4).) The average error at wormshaft frequency can then be completely subtracted from the hobshaft-to-table error curve.

The average error at hobshaft frequency can next be abstracted from the hobshaft error curve. This average represents the error in the driving gear on the end of the hobshaft, which may be due to a pure or concentric cumulative pitch error in the teeth, a local pitch error, an eccentricity of cutting, an eccentricity of mounting or any combination of these factors. The separate inspection reports for the hobshaft, the driving gear, and the assembly may be examined for information on the source and on the possibility of neutralization by rotation of the gear on the hobshaft. The average error at hobshaft frequency can then be completely subtracted from the error graph, and the process continued.

If the machine has been designed in accordance with the recommendations in B.S. 1498:1954 (Gear Hobbing Machines), it is most unlikely that errors in any gear in the hob-to-table circuit further back than the wormshaft driving gears and the hobshaft driving gears will cause noticeable undulations in the error graphs, because of the reducing effect of high gear ratios. The operative clause in the British Standard is: "A high reduction in the final drive from the input shafts to the main worm and the hob spindle should be arranged." It is regrettable that in some recent machines this clause has been ignored, and in such cases it may be necessary to take out further average curves at the frequencies concerned, beginning with the pinion shafts in the hob and worm driving gear pairs, and to make corrections and adjustments which would not have been required had the above recommendation been followed.

#### REFERENCES

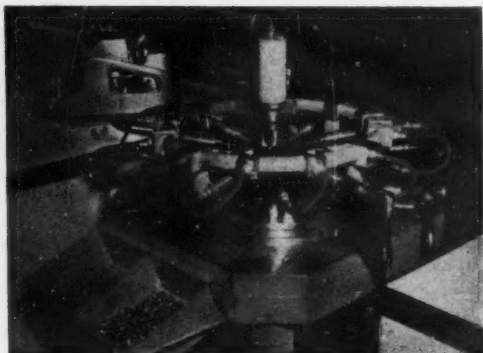
- (1) "The Measurement of Periodic Errors in Gear-Hobbing Machines." By C. Timms, M.Eng., A.M.I.Mech.E., A. A. King, and L. E. Jeans. *Engineering*, Oct. 8, 1948.
- (2) "Accuracy in a 72-in. Hobbing Machine." David Brown Machine Tools, Ltd., Manchester. *Engineering*, Aug. 5, 1952.
- (3) "Helical Gears Cut on Solid-table Machines." By S. A. Couling, A.M.I.C.E., A.M.I.Mech.E. *The Engineer*, April 22, 1949.
- (4) "Gear Hobbing and Shaving." By A. Sykes, B.Sc., Wh. Ex., M.I.Mech.E. David Brown Industries, Ltd., Huddersfield.
- (5) "Analysis of Gear-tooth Undulation Records." By P. M. Gillet, Nat. Stds. Lab. C.S.I.R.O. *Engineering*, Sept. 21, 1951.

# Round Olympia With a Camera

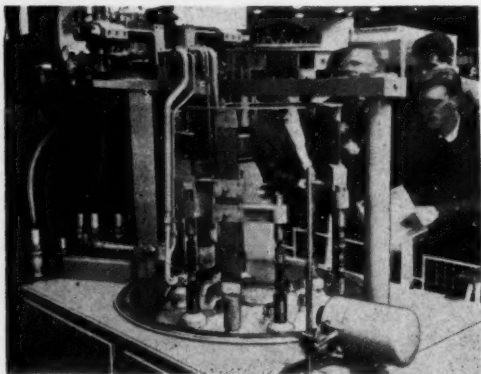
## The Production Exhibition



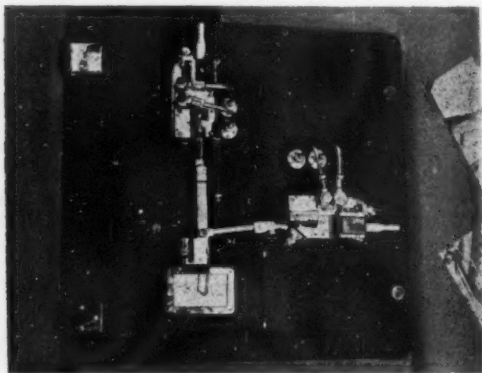
Exhibits on the stand of the Zinc Alloy Die Casters Association included these zinc castings made by Sparklets, Ltd., to illustrate the advantages of the vacuum die casting process. One casting was produced under vacuum and the other by the conventional method, and both were subsequently stoved at 330 deg. C. to simulate a normal enamelling procedure. This resulted in the formation of the blisters seen on the right-hand casting, which are entirely absent from the vacuum casting



With this machine made by Shoreham Precision Tools, Ltd., shown on the stand of Desoutter Brothers, Ltd., two sizes of ball chain sprockets can be dimpled. The sprockets are employed in the ribbon-driving mechanism of the Underwood Golden Touch typewriter seen in the background. After loading and clamping the component, the operation is performed by moving the handle in the foreground, which advances, and simultaneously starts, the 12 Desoutter M63 pneumatic drills

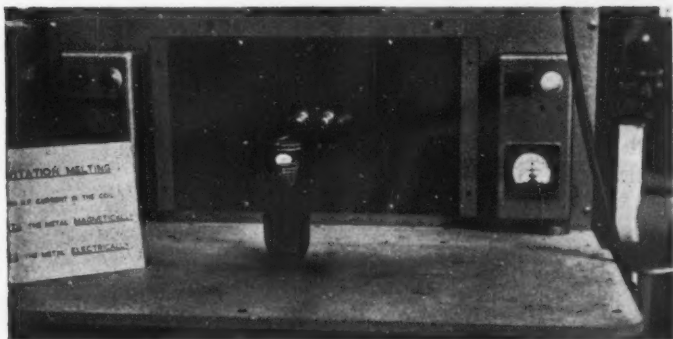
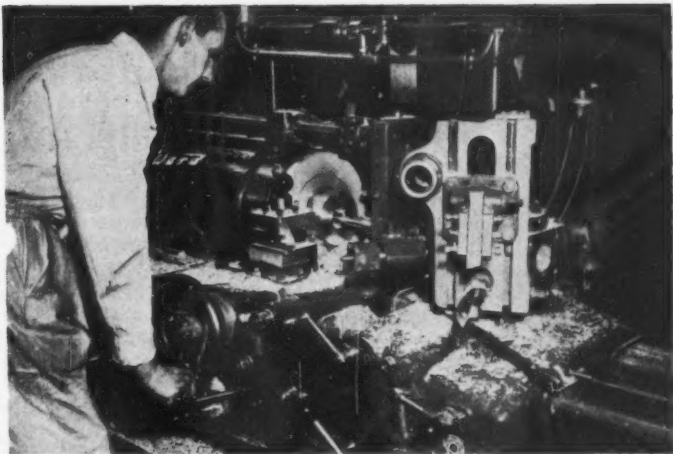


Two systems of control may be employed on this Peddinghaus automatic machine, exhibited by Surfard, Ltd., to govern the temperature at which quenching is performed. One of these systems employs a timing apparatus to initiate the movement of the indexing table to carry the heated part to the quenching position. The other method utilizes the Milliscope pyrometer seen in the right foreground to measure directly the temperature of the component by comparing its colour with that of a calibrated incandescent lamp



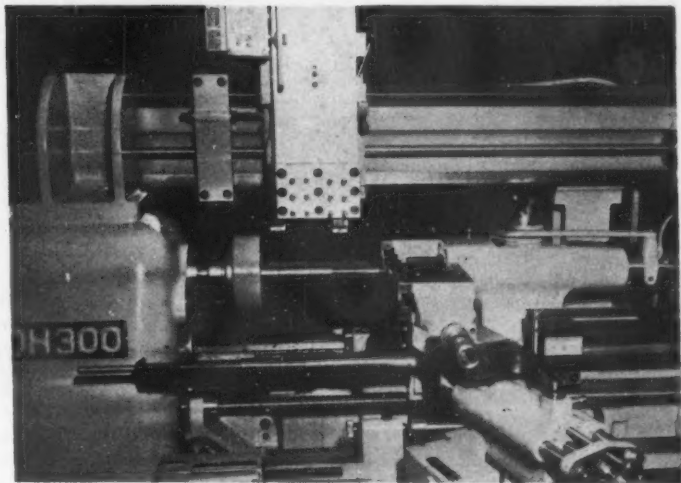
This servo-controlled mechanism, which, in a more advanced form, could be employed for the positioning, of either a tool or component automatically and accurately, employs electro-hydraulic units and was demonstrated by Rotol, Ltd. The mechanism was controlled by a tape recorder which could be fed with signals by drawing on a pad in an input unit. Signals from the tape were then fed into the two electro-hydraulic actuators shown, linked to a pen, which was thus caused to trace out a copy of the original drawing

The ease with which components made from magnesium alloys can be machined was demonstrated with this set-up, on a Ward No. 7 lathe, on the stand of Magnesium Elektron, Ltd. In the sequence of operations on textile machine flanges, which were performed with the highest available spindle speed of 1,000 r.p.m., and with high feed rates and heavy cuts, a total of 40 cu. in. of metal, weighing  $2\frac{1}{2}$  lb., was removed in a floor-to-floor time of  $2\frac{1}{2}$  min.



Levitation melting was demonstrated on the stands of Radio Heaters, Ltd., and the British Electrical Development Association. The first-named exhibit is here shown, and employs a 6-kW., Radyne unit operating at a frequency of 450,000 cycles per sec. The blob of aluminium alloy here seen within the coil is supported magnetically while it is heated by the high-frequency current. Other exhibits on this stand included shaft-hardening and induction brazing set-ups

On the Magdeburg DH300 semi-automatic lathe exhibited by Hicks Machinery, Ltd., the new mechanically-operated overhead plunge-forming and facing slide was demonstrated. Tracer-controlled tools on the front and rear slides were employed to carry out roughing and finishing cuts simultaneously on the shaft, and the vertical slide was then fed in automatically to cut two grooves in the periphery. Control of the vertical slide motions is by means of limit switches operated by adjustable dogs on a bar attached to the slide, which actuate electro-magnetic clutches



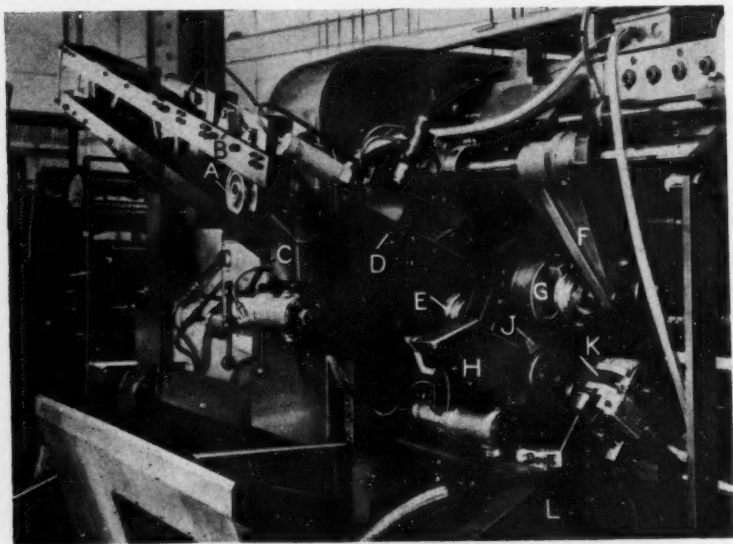
## Machining Both Sides of a Component on a Wickman Chucking Automatic

In the accompanying illustration is shown a Wickman 6½-in. capacity 6-spindle automatic, fitted with loading and unloading equipment for handling a cast iron workpiece. An interesting feature of the arrangement is that the machine is set for double indexing, and means are provided for turning the casting through 180 deg., and re-loading it, so that operations are performed on both sides during the one cycle.

The castings, as seen at A, are placed by the operator in the inclined magazine, and are released, in turn, by an air-operated latch B, into a holder C. This holder is then turned through 90 deg., by means of an air cylinder, and the casting is discharged into a chute D, where it is arrested at the position E, ready to be picked up by a loading arm F and inserted in the chuck G, at station No. 5. The swinging and axial movements of the loading arm are air-operated, and the workpiece is gripped by means of spring-loaded fingers, which enter the central hole.

After the spindle drum has double-indexed, in the anti-clockwise direction, to bring the work successively to stations No. 1 and No. 3, at which the machining operations on one side are carried out, and then back to the starting position (No. 5), the casting is removed from the chuck by the loading arm F, and placed in a holder H. This holder is then turned through 180 deg. by means of an air cylinder, so that the workpiece is reversed and falls into the jaws of the secondary loader K, which transfers it to the chuck J on the spindle at station 6.

Machining operations are carried out on this side of the workpiece at stations No. 2 and 4, and the completed casting is then removed from the chuck by the loading device K, and deposited in the chute L. Careful arrangement of the tooling has enabled 19 operations to be performed at the four working stations, and the cycle time for the complete sequence of cutting and loading operations on the machine is only 30 sec.



**Wickman 6½-in. 6-spindle Chucking Automatic Fitted with Work Handling Equipment which, in Conjunction with Double Indexing, Enables Both Sides of a Casting to be Machined during One Cycle**

**DEVELOPMENT IN THE STEEL INDUSTRY—** Figures included in a booklet published by The British Iron and Steel Federation indicate that the cost of the post-war development programme for the steel industry has so far amounted to about £600 million. By last year, the rate of expenditure had risen to nearly £100 million per annum and is expected to continue at this level into the 1960's.

Output of steel in 1957 was 21.7 million tons or 71 per cent more than in 1946. By 1958, productive capacity will have risen to 23½ million tons, and by the early 1960's to 29 million tons per annum.

# Die Casting Supplement

## Work Transfer Methods in Die Casting Production

By H. K. and L. C. BARTON

For half a century or more, die casting has been a process quite obviously possessed of enormous potentialities for fast and invariant production, but only during the years since the war has the gap between potentialities and actual achievement begun to be decreased. What die casting, as a process, is capable of in speed, precision, and reliability has been clearly shown, at least since the beginning of the century, by the various sorts of type-casting machine, which produce (and in many instances transfer and stack in order) separate characters or slugs forming lines of type. In some of these machines, the selection of an appropriate succession of matrices or dies, and the injection of metal into them, is controlled from a manual keyboard directly. In others, a similar keyboard produces a punched tape upon which the selection instructions are coded, and the prepared tape is fed into a separate type-casting machine.

Such machines, from their inception, have embodied many of the principles that now find wider application in multi-station installations for the processing of a variety of products. Their early successful development was due to the very limited range of distinct pieces that had to be produced and, of course, to the enormous quantities in which pieces of type were required. The absence of any need for durability in the product, also the low melting points of the alloys, and their capacity for high definition were contributory to the development of type-casting as an almost completely automatic variant of the normal die-casting process.

The lines along which the die casting process must necessarily develop have accordingly been clear for a very long time, but only fairly recently have improvements in control mechanisms made it

possible to extrapolate the procedures that operated effectively in casting a fraction of an ounce of type-metal, and apply them with equal effectiveness to far larger and more complex components in zinc and aluminium alloys. At present, the most fully automated installations for producing small zinc die-castings fall little short of type-casting in speed, and sometimes involve more elaborate work cycles, while for larger components, the extent to which production is rendered automatic no longer depends upon technical limitations, but is solely a matter of economics.

Where the required quantities will amortize the ancillary control equipment and transfer devices (which may cost several times as much as the dies themselves), virtually any component can be cast in a fully-automatic sequence embracing all necessary secondary operations. Commonly, however, such a degree of automation is not called for. A break in the processing cycle may, in fact, be advantageous when there is considerable disparity in the times needed to carry out two successive operations. Other factors, too, militate against completely automatic "in-line" processing, one of which—at least for the present—must be particularly stressed, namely the processing of sub-standard castings that inevitably takes place when components are transferred directly from the die to a train of secondary tooling.

It does not actually make much difference to the overall efficiency of in-line processing if a proportion of sub-standard castings is passed through and subsequently rejected, since the total output of sound castings remains the same at whatever stage the faulty ones are detected. It frequently happens, however, that the performance of a secondary operation makes it more difficult to detect a fault. For example, it is possible to

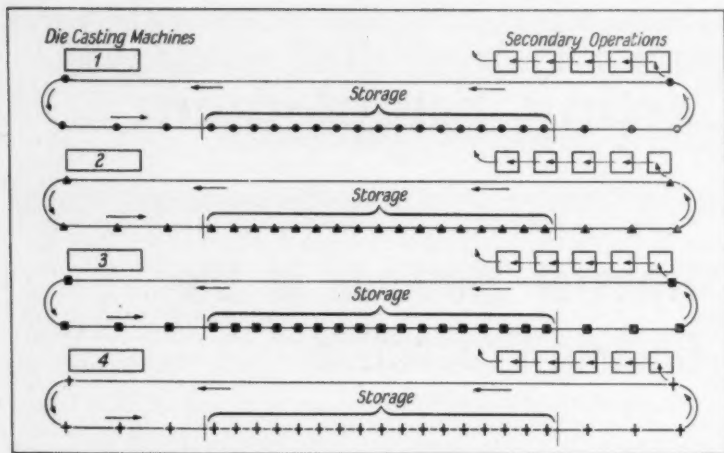


Fig. 1. With this Layout, each Die Casting Machine has Its Individual Storage Conveyor and Associate Processing Line

detect blemishes in a cored-out bore, caused by the trapping of air, with one hundred per cent efficiency by a quick visual inspection of the as-cast holes, with their smooth reflective surfaces. Once the holes have been tapped, on the other hand, such faults are much less easy to detect. There is also the disadvantage that certain faults (such as the breaking of a core-pin forming a hole that is to be tapped) originating in the casting process may result in damage to tools at a later stage. There are thus cogent reasons why something short of completely automatic processing may be desirable for many die castings, even where it would appear, at first sight, to be practicable.

#### THE IMPORTANCE OF INSPECTION AT THE MACHINE

On all but the very smallest machines, it is, in fact, desirable that the operator should be able to inspect the casting as it comes from the die, and before it passes to the trimming station. Since the usual locations of faults soon become known to the operator, quite cursory inspection establishes the general soundness of the component. Moreover, the operator has the advantage over an inspector, to whom the casting comes "out of context," as it were, that he knows in advance what sort of faults he is looking for, since, to a large extent, defects are correlated with fluctuations in operating conditions. Flow-marks and seams, for instance, are most likely to occur just after the machine is started up, following an extended pause, whilst the application of excessive lubricant may

result in trapped gases and a highly porous casting which a conscientious operator will discard even if there are few external signs of the defect.

The most compelling argument against in-line processing, with an uninterrupted work cycle, however, is that it unnecessarily increases the average processing time per part. To obtain maximum machine-time utilization it is desirable to operate die casting machines on a two- or three-shift basis, and with ordinary batch methods of carrying out secondary operations it is normally possible to

process the whole 24-hour output of the foundry during a single day-shift. This procedure has many operational advantages—in particular it facilitates the use of female labour—and unless the sequence of secondary operations can be made entirely automatic, so that individual operators are not required except at the die casting machines, the spreading-out of finishing processes over the whole 24 hours is not justifiable.

This admitted fact is sometimes used to bolster up assertions that in-line processing, as such, is not really tenable—or is intrinsically inefficient—under the peculiar conditions obtaining in die casting production. Nevertheless, the only point that need be conceded is the divorce of production at the machine from the secondary operations. If the tempo of the latter be increased so as to average two and a half to three times the casting rate, single-shift in-line processing can be quite satisfactorily linked with 2- or 3-shift machine operation.

In writing "production at the machine" rather than "production in the machine" in the foregoing paragraph, the intention was to avoid separating the casting operation, as such, from the rest of the work-cycle. In some instances, as will be shown, it is more advantageous to carry out some trimming and other operations at the die casting machine than to include them in the faster sequence of secondary operations. Provided that the performance of these additional operations does not slow down the casting cycle—and it is found that where automatic transfer from die to trimming

tool is adopted, the casting cycle tends to be reduced rather than lengthened—there is no particular reason why they should not precede the break in the work cycle.

#### CONVEYOR SYSTEMS ARRANGED FOR WORK BANKING

Recent improvements in conveyor systems have made them much more adaptable to interrupted work-cycles, and various means of shunting work from the main driven conveyor into un-driven sidings—"dead lengths"—and of disconnecting the drive from loaded carriers so that they bank up along the conveyor instead of being carried forward, are of particular interest in this regard. Banking the work on a stretch of the main conveyor is the simpler method mechanically, and an installation of this sort (Fig. 1) at the Graisley Hill Works of the Wolverhampton Die-casting Co., Ltd., has previously been described (MACHINERY, 90/707—29/3/57) in some detail.

The essential features of such a conveyor are that the operator of the die casting machine should be able to engage a loaded carrier with the driving chain at will (continuously moving work carriers are not ideally suited to the die casting shop), that the carrier should automatically disengage on reaching the storage length, and that carriers from the bank thus formed should be capable of engagement with the driving chain and delivery to the first secondary operation as desired, and at a rate in no way affected by the rate at which loaded carriers are fed in. Where both the die casting machine and the finishing line operate over the same working periods, such a conveyor provides a buffer stock to keep the line going should casting be interrupted for a period. A storage conveyor of adequate capacity to bank the output for a complete shift, however, allows of continuous working in the die casting shop, and intermittent or single-shift working on the secondary operations.

In the installation of

Fig. 1, each die casting machine has its own conveyor, and this is a necessary feature (except in the unlikely event that all the machines are producing the same component) because carriers are released from the bank in the same order as they entered. A conveyor of this sort, serving a battery of machines engaged on miscellaneous production, would bank and release the work in a random manner, and it would be difficult to arrange a simple means of delivering the carriers to their appropriate processing stations.

This difficulty is obviated by the use of a main conveyor provided with as many sidings or branches for storage as there are productive units. Each die casting machine then has its assigned storage conveyor into which the loaded carriers are automatically shunted. The storage conveyor may be "dead" or—preferably, for die casting purposes—may consist of a subsidiary closed-loop conveyor that can be made intermittently "live." Such an arrangement enables the work to be fed back into the main conveyor at will. With an installation of this sort—for example, the "Teleflex" conveyor displayed at the recent Mechanical Handling Exhibition (MACHINERY, 92/1118—9/5/58)—two different methods of operation are possible.

With the first method, the storage loops serve also as feed conveyors to the secondary-operation line, as indicated schematically in Fig. 2. Work

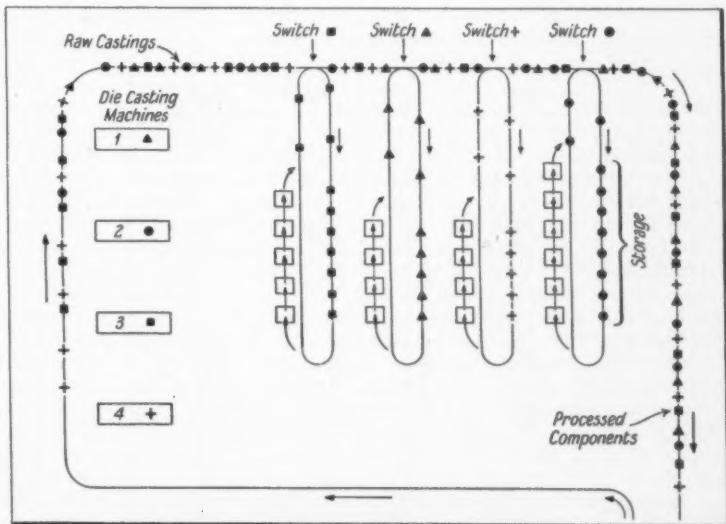


Fig. 2. A Single Main Conveyor Here Accepts Work from All the Machines and Distributes it to the Various Storage/Feed Conveyors by Means of a Switching System

may be re-loaded after it has been processed, and fed back to the main conveyor for transfer to another department, and scrap and trimmings may likewise be conveyed to the foundry for remelting. To ensure that the work carriers are initially shunted to their proper storage lengths it is, of course, essential that the system should be selective, and the same means of selection may be utilized to re-route partly- or wholly-processed work through the system. In the "Teleflex" installation, this result is achieved by a simple switching device. Each carrier continues along the main conveyor until it engages an appropriately-positioned trip-lever, which diverts it into an adjacent storage loop. For easy recognition by operators the carriers assigned to each storage loop are colour-marked.

With the alternative method, depicted in Fig. 3, the loop conveyors serve solely for storage, the processing lines being served by dead or gravity-feed branches, as indicated. This arrangement has the advantage that the construction of the storage loops can be very simple—there need, for example, be no rise or fall, or horizontal convolutions, to bring the carriers to an appropriate delivery point—and their locations can be freely determined. The loops can therefore occupy space high above the working area of the shop and can, indeed, be tiered, should this be desirable, since it is possible to feed into a storage loop from any point on a rising or falling stretch of the main conveyor.

At the bottom of the sketch is seen the discharge

end of the system, consisting of a series of branch conveyors for feeding the various processing lines. These branches, if necessary, may also be looped for bringing processed work back to the main conveyor, as for the first method described. Since the storage and feed conveyors may be separated by a considerable distance, there is likely to be an appreciable delay between the release of work carried from storage and its entry into the appropriate feeding loop. It is therefore desirable that each feed conveyor should provide for storage of half a dozen or so carriers, and the controls should be linked so that, when a carrier is released from this latter stock and brought to the work-station, another carrier is released from storage automatically. After travelling along the main conveyor, this carrier is automatically switched into the feed loop to replenish the buffer stock.

As will be clear from the layout, the storage loop can be kept switched out of the circuit if necessary, and work from the die casting machine carried direct to the temporary storage bank of the processing line. This may be desirable if, for example, it is found that damage to a die—perhaps a core breakage—has occurred during the night shift with the result that a long succession of components is faulty and unsuitable for the normal processing sequence. It can also be arranged without difficulty, in all conveyor systems incorporating a disengageable drive to the work carriers, for the switching device to cease to operate should the storage loop be completely filled. Subsequent work carriers are then carried forward and switched into the temporary storage bank, if one is provided, or are carried round and round the main loop until the processing of components has left a gap in the storage loop, and the switching device can again operate.

Most of the foregoing features can also be obtained with the simpler and less expensive layout seen in Fig. 4, although at the cost of some flexibility of vertical and horizontal positioning. As will be observed, the main conveyor is again a closed loop serving the various departments. Work from the die casting machines (bottom centre) is placed directly on the conveyor carriers and moved to the left, where the main conveyor rises slowly to a higher level, as indicated. From this level a series of dead branches—merely rails on to which the carriers can be diverted—are pro-

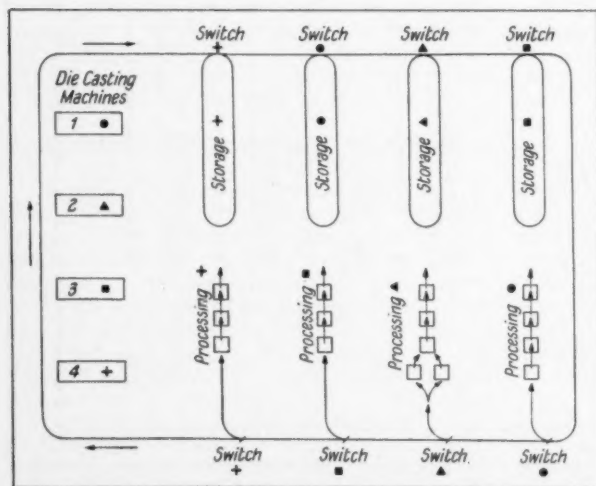


Fig. 3. An Alternative Layout with Separate Storage and Feed Conveyors

vided, with selective switching as already described. After this infeed length, the main conveyor descends to a slightly lower level—a foot or so fall suffices—and returns down the other side of the shop.

It is thus possible for the storage branches to be given a slight inclination, so that work is banked up at the lower ends and can be fed out easily on to the main conveyor again, for transfer to the processing lines or—where batch processing is practised—for discharge in the fettling shop. The processing stations may likewise be fed by branch lines with gravity fall, as shown on the right, but since these branches will, in general, be required to descend to a fairly low level, the feeding back, of partly-processed work, scrap castings, and trimmings to the main line should not generally be attempted.

By the use of one or other of the systems described, which are susceptible of considerable detailed modification to suit the requirements of particular shops, the difficulty of bulk storage and of correlating the rate of processing with the rate of production is eliminated. The combination of conveyance and storage eliminates handling and floor transport, and, in normal operation, assures the processing of components in the order of casting just as in uninterrupted line production. With this problem surmounted, improvements in the detailed handling of parts at the die casting machine and during processing can be considered.

At the present time it is usual, even on machines working to a fully-controlled operating cycle, for removal of the casting from the die to be performed manually. Smaller castings may drop from the ejectors, but with such parts we are not at the moment concerned. When, however, castings are of such a size and shape that manual removal is slow and difficult, or when clearance between the dies is only slight, it becomes necessary to provide some degree of mechanization, or at least of mechanical constraint, when the casting is being moved laterally between the die members. Such provision is essential merely to ensure that the casting is moved along exactly the same path at every cycle, and does not foul projecting parts of the tool.

Until recently it had been tacitly assumed that unless a casting presented extreme difficulties of removal, the use of transfer devices could not be justified, but as the possibility of faster and fully-automatic work cycles is now beginning to be implemented, it is obvious that within a few years transfer mechanisms will become standard equipment on machines above, say, the 150-ton size. Of the great variety of transfer methods devised in past years, however, few are of really

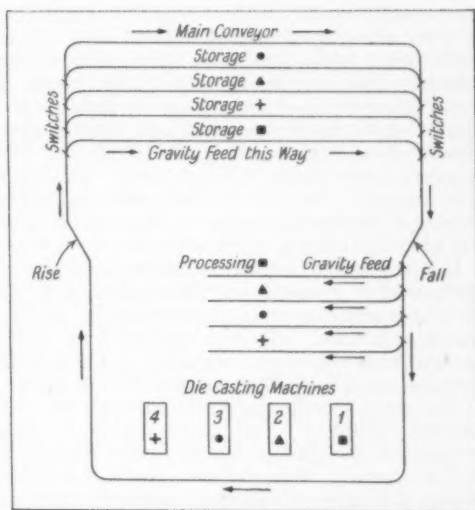


Fig. 4. By Arranging for Appropriate Changes of Level in the Main Conveyor, Castings May be Banked on Inclined, Gravity-feed Storage Tracks

general application (since they were virtually all developed for specific and rather typical components), and only two broad lines of approach seem likely to prove of real value in the long run.

#### TRANSFER ARRANGEMENTS FOR REMOVING CASTINGS FROM MACHINES

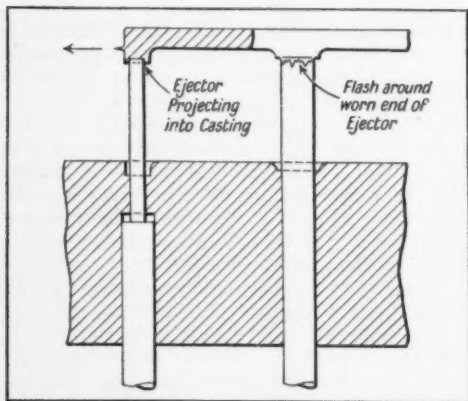
In early attempts to remove castings from the die by mechanical means, it was sought to simulate the hand of the operator, by arranging that the sprue should be gripped in various ways, preparatory to jerking the spray of castings sideways off the ejectors. This method never proved satisfactory over an extended period of operation, since the resistance to a straight sideways pull is considerable as soon as the ejectors become even slightly worn or axially displaced, as indicated in Fig. 5. Although this difficulty can be overcome by imparting a compound movement to the gripper, the mechanism is thereby rendered much more complicated. The only instances where a transfer device of this type is preferable to the mechanisms described below, are those in which it is necessary to rotate the component about the axis of the sprue in order to achieve an orientation more favourable to withdrawal between the tie-bars.

The simplest general-purpose method of unloading work from the die casting machine, and one

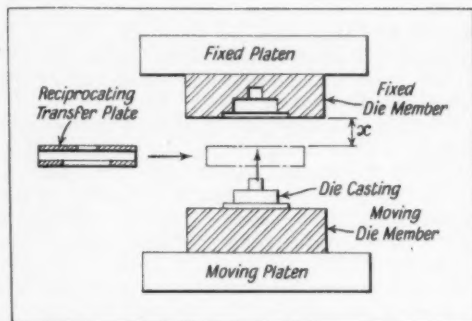
that usually entails no alterations to existing dies, is to use a transfer plate reciprocating along a fixed path normal to the axis of die travel, as in Fig. 6. Distance  $x$  is determined jointly by the length of the opening stroke of the machine and that of the ejector stroke needed to bring the casting completely clear of the moving die member. The transfer plate consists of a light frame carrying a sufficiency of locators—bushes, pins, or plates shaped to the casting profile—to support the casting when the ejectors are withdrawn.

In operation, as indicated in Fig. 7, the die is opened after injection has taken place and the moving member is completely retracted. If the machine is fitted with rack-and-pinion or independent ram ejection, as is general in the U.S.A., although not yet so common in Europe, the casting, at this stage, is still completely engaged with the moving member. The transfer plate is then moved into the die space and comes up against positive stops to align the nest with the casting. When the latter is ejected from the moving member, it is thrust forward into engagement with the transfer plate, and the ejectors are immediately retracted again to leave the casting supported by the plate. Finally, the plate is withdrawn laterally from the die, the component being unloaded, as a rule, by an assistant while the next casting is being made.

On machines arranged for bumper-bar ejection, the design of the transfer plate and the sequence of the operations are necessarily somewhat different, as indicated in Fig. 8, since the casting



**Fig. 5. Withdrawal of the Casting in the Direction of the Arrow is Rendered Difficult by the Fact that it is Partially Anchored to the Ejector Tips. A Small Movement Away From the Ejectors Must Usually Precede Lateral Removal**



**Fig. 6. The Transfer Plate is Moved into the Die Space to Receive the Casting as it is Thrust Forward on the Ejectors. Transfer Plates Normally Require Detents or Latches to Prevent the Casting from Being Dragged Out Again as the Ejectors are Retracted**

moves back for only part of the die stroke, and thereafter remains stationary while the die completes its movement. It is necessary, therefore, to engage the casting laterally, and the fixture or nest takes the form of a set of rods or shaped rails so positioned as to support the casting at points not likely to be effected by flash formation. Guide rails may be cut from thin steel strip or formed from rod, and are normally welded to a rectangular frame.

When fully engaged with the fixture, the casting is, of course, still supported on the ejectors. The fixture must therefore have a certain amount of over-run, and during the additional portion of the stroke it is displaced slightly, in the forward direction (by means of a roller and plate-cam or its equivalent), so that the casting is freed from the ejectors. It can then be moved sideways out of the die space, leaving the tool free to be closed for the next shot. The casting may be slid out of the fixture by hand, or, as in the sequence depicted in Fig. 8, may be arrested by a stop before the fixture has completed its outward movement. On being thus discharged from the fixture, the casting is usually allowed to slide down a chute into a shallow water-quench. Alternatively, as seen in Fig. 9, large castings may be transferred to a conveyor, on which they are carried forward to a processing station.

If hydraulic rams of small bore and long stroke are utilized, their operation can readily be incorporated in the controlled sequence of machine movements, and unloading them becomes entirely automatic. With such an arrangement, the

operator has, in effect, more time to inspect the die faces, ejectors and cores at each shot, even if the period during which the die remains open is, in fact, reduced. Occasionally, the operator may need to over-ride the selector control and delay die closure by means of the manual control, in order to remove metal debris or apply lubricant. For the most part, however, a die so equipped can not only operate on continuous cycle with a predetermined "open-die" phase (for this is always possible if the dwell with the die open is sufficiently long) but can work with minimum dwell.

The sequence of simple work unloaders shown in Fig. 7 to 9 serve to indicate the elementary

functioning of such devices, and are a necessary background to the description of more complex mechanisms. Actually, the more complicated sequences were employed first, and it is only very recently that the economies inherent in fitting unloaders that do nothing also have been realized. The first devices of this kind to be introduced were developed from manual insert-loaders, examples of which have frequently been described in MACHINERY's Die Casting Supplement. A simple insert-loader, illustrated in Fig. 10, consists of two plates A and B, slidably joined.

The plates are held in position by rods R, which slide in guide bushes mounted in the plate B, the

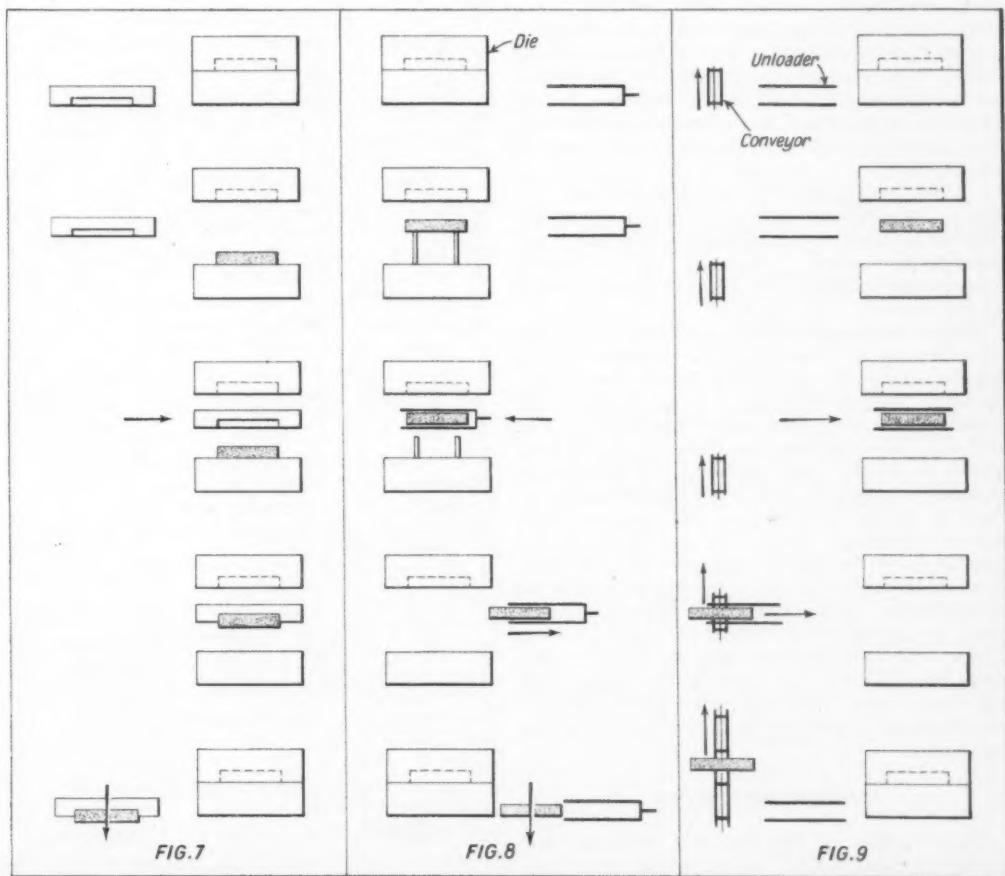


Fig. 7. Work Transfer Sequence with Manual Removal of the Casting. Fig. 8. Work Transfer Sequence Arranged to Provide for Automatic Discharge of the Casting into a Chute. Fig. 9. Work Transfer Sequence Arranged for Automatic Delivery of the Casting to a Conveyor

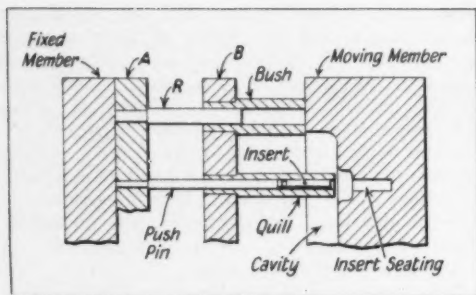


Fig. 10. A Simple Insert Loader

parts being so dimensioned that the end of the rod *R* comes flush with the end of the bush just before *A* comes into contact with *B*. The inserts to be loaded into the die are placed in quills, disposed on the same centres as the insert seatings in the cavity, and the loader is placed between the die blocks. It is located on the register pins—or other pins specially provided—so that the inserts are aligned with their respective seatings. The die is partly closed, to collapse the loader and transfer the inserts to the die, and the moving member is then withdrawn again to permit removal of the loader.

Since insert-loaders (or "pre-loaders" as they were first termed) are most valuable when a large number of inserts is to be positioned at each shot, it often proved difficult to make loaders sufficiently light to permit ready handling. This difficulty was overcome by providing a rail from which the loader could be hung, and upon which it would be run into and out of the die space—at first, by hand. The obvious next step was to fit an air cylinder to reciprocate the loader and a pair of micro-switches to control its transfer position. With such a set-up, there is one operational disadvantage, namely that the moving member must be backed off to permit withdrawal of the loader. The necessary backing off, however, presents less difficulty now that it did a few years ago, since with most electronic control systems provision can readily be made for the additional movement.

#### LOADER/UNLOADER DEVICES

From devices of this sort was developed the loader/unloader, which, in its initial form, was merely re-inserted as the die opened, to receive the ejected casting. Such an arrangement was obviously only practicable when the components incorporated fairly robust "through" inserts, and

the sequence is shown in Fig. 11. To provide for components with shrouded inserts, such as the mushroom-like knob in Fig. 12, a double ended loader/unloader was required. One end carried a pre-loading fixture, and the other a transfer plate, which, in this particular instance, required only a set of circular nests. These items were secured at the ends of a reciprocating member mounted above the die space, as seen in Fig. 13,

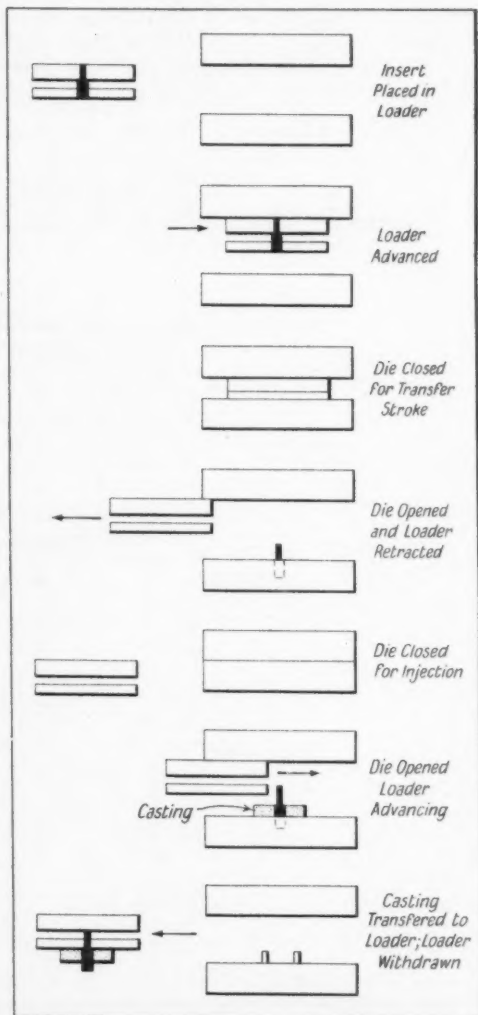
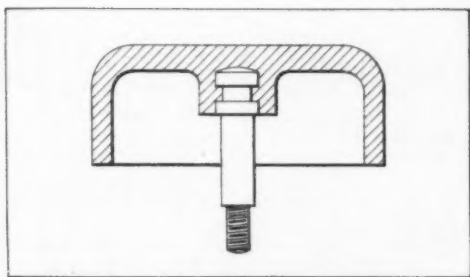


Fig. 11. Here a Reciprocating Insert Loader is Utilized also for the Removal of the Casting from the Die



**Fig. 12. If the Insert Does Not Pass Through the Casting, but is Shrouded, it is Necessary to Provide Separate Loading and Unloading Fixtures**

in such a way that they could be brought alternately into alignment with the cavities.

The sequence was then as follows: (1) advance loader into open die; (2) partly close die to transfer inserts; (3) withdraw moving half to clear loader; (4) retract loader to neutral position; (5) close die fully; (6) inject metal and pause; (7) open die and advance unloader; (8) eject castings from cavity into unloader; (9) retract unloader to fully withdrawn position and thus (1) advance loader into open die. With this set-up, the operator can recharge the loader with inserts, and the assistant can remove the castings from the unloading fixture, during the "closed die" phase of the cycle. In order that these operations can be performed in safety, the machine guard should be arranged to advance immediately after stage (4) of the sequence.

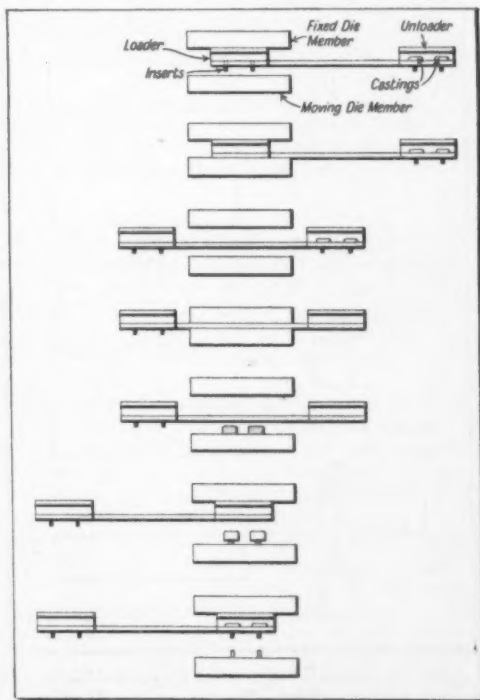
A rather ingenious variant of this arrangement, developed by colleagues in the U.S.A., may be described here, since, although it is not of general application, it does simplify the sequence in instances where it can be adopted. With this method, a loose cavity plate, which remains in position within the die during injection, is employed as a loader (Fig. 14). The sequence is thus reduced to: (1) advance loader into open die; (2) fully close die; (3) inject metal and pause; (4) open die and advance ejectors; (5) retract ejectors; (6) retract loader, remove spray of castings, position new set of inserts and (1) advance loader into open die.

The main reason for adopting this type of loader/unloader would appear to have been increased ease in locating a small number of long inserts that could not easily and safely be placed in the cavity of a normal die. In the past, this difficulty has occasionally been circumvented by arranging for the whole moving member to slide

laterally across the platen into a position which afforded adequate loading clearance. Where the cavity in the moving member is shallow, however, the use of a lighter, sliding, cavity plate as a loader is clearly an improvement.

A partial section through the closed tool (Fig. 15) indicates one of the more significant limitations. From the sequence indicated above, it will be noted that ejection takes place before the loader is reciprocated out of the die space. Actually, the ejector stroke is so arranged that, whereas the castings are freed from the cavity proper, the inserts are left partly engaged with their seatings. This stroke must also provide for a slight clearance between the forward end of the insert (or in some cases the tip of the sprue) and the face of the fixed member. With the castings lodged loosely in this manner, the ejectors are retracted to allow the plate to be moved sideways out of the die.

This ejection sequence necessitates the location of the ejector tips below the surface of the moving member when they are fully retracted, as in the figure. In consequence, the inserts are not



**Fig. 13. Work Transfer Sequence for a Loader/Unloader**

supported by the ejectors, and must either be shouldered at, or below, the cavity intersection (some are, of course, ground on the exposed length for functional reasons) as on the left, or, if of large size—so that an ejector of smaller diameter is sufficiently stiff—must be located at the bottom of the seating, in the manner indicated on the right. The two inserts are of different lengths, and it will be noted that, since the distances  $x$  and  $x_2$  must be the same for both, the ejectors

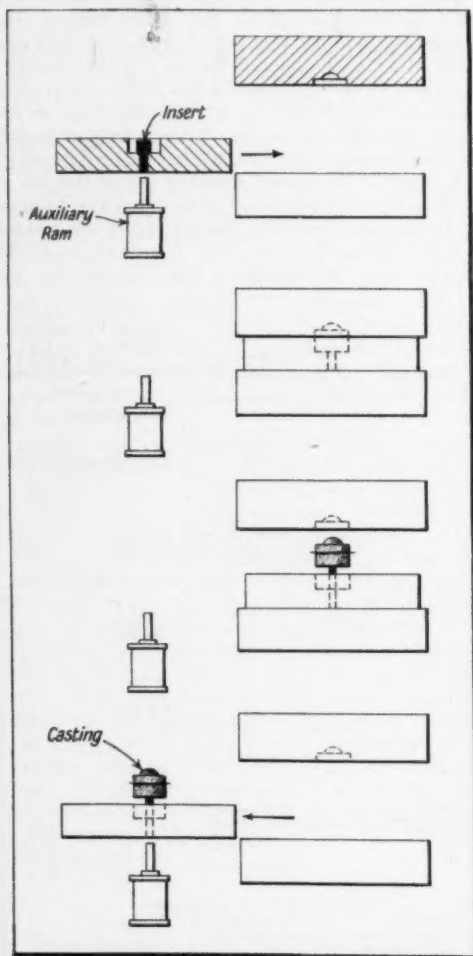


Fig. 14. Work Transfer with a Laterally Reciprocating Cavity Plate. The Normal Die Ejectors Loosen the Casting in the Plate and Ejection is Completed by the Auxiliary Ram on the Left

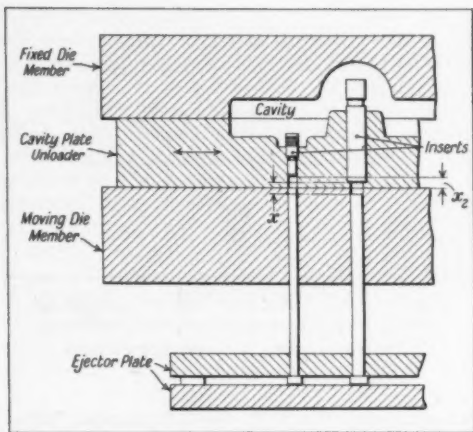


Fig. 15. Sectional View of a Tool with a Reciprocating Cavity Plate/Unloader

are set back different distances from the face of the moving die block. In this particular example, where the difference is small, this requirement is not a serious drawback, but if the disparity were great, the free travel  $x$  is likely to occupy an excessive proportion of the available ram stroke.

At present, insert-loading techniques and excavator transfer methods generally are undergoing rapid development, and it was recently announced by a leading U.S. maker of die casting plant that large machines can now be supplied complete with transfer mechanisms capable of most of the movements described above (for a complex loader can normally be adapted to a simpler sequence), and with provision for trimming the components as they are held in the unloader. This last feature indicates the direction in which the future of automatic casting transfer lies. Although, from the standpoints of safety and speed it is certainly a considerable advance to remove work from the die mechanically, even if it is then merely thrust free or removed by hand, the advantage, in many instances, of transferring directly from the die to a trimming station is obvious.

THE PRODUCTION OF COMMERCIAL MOTOR VEHICLES, of less than 15-cwt. carrying capacity, during the first three months of this year, totalled 13,609, 13,888, and 17,066, the last figure, it should be noted, being for March, which was a 5-week period. The corresponding totals for 1957 were 8,863, 9,752, and 13,379.

## Some Examples of Plastics Tooling

By V. L. FULCHINO\*

In the development and production of small gas turbine units for aircraft, the tool engineers encounter many problems. To maintain a competitive position in this expanding industry, the General Electric Co., U.S.A., recognized that tooling of the necessary quality must be produced quickly and economically. Small aircraft units require close-tolerance parts of such intricate forms that the practice of making a small initial batch without tooling could not be adopted for the majority of components. In overcoming this problem, a new approach to tooling was tried, and the application of plastics to tool and die manufacture was evaluated and accepted. Experience with the use of plastics so far has resulted in substantial savings in practically every instance, and sometimes the reduction in the cost of a tool has been as much as 85 per cent.

Various kinds of plastics materials are available for tooling applications, and the most common are based on polyester, phenolic or epoxy resins. Plastics of the first two types have found only limited use, but the epoxy-based plastics are used for approximately 95 per cent of the tooling requirements at the small aircraft engine depart-

\* Small Aircraft Engine Department, General Electric Co., U.S.A.

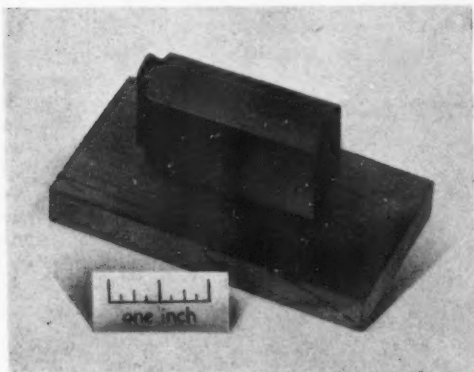


Fig. 1. Plastics Knockout Block, Which Has Been Used in Place of a Similar Steel Part, for a Trimming Die Employed in the Production of Forgings for Turbine and Compressor Blades

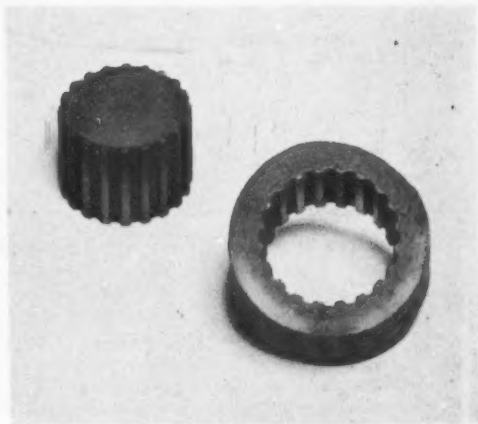


Fig. 2. Difficulties Associated with the Inspection of the Internal Splines of the Part Seen at the Right were Overcome by Casting a Plastics Replica, Shown at the Left

ment of General Electric. Various types of epoxy resins and hardeners are available which will produce stable plastics materials, when mixed in the correct proportions and cured at room temperatures for a specified number of hours. The type of material to be used is determined by tooling requirements.

Many interesting examples of the applications of plastics tooling are concerned with the manufacture of the blades for turbines and compressors. Since these parts incorporate aerofoil contours, the cost of steel tools would have been prohibitive. For example, it is required to hold and locate a compressor blade by the aerofoil section during milling, grinding and checking operations on the dovetail root portion. A suitable fixture can be made readily by moulding plastics material around the aerofoil blade. Similarly, plastics milling fixtures for compressor blades have almost entirely replaced those of the conventional steel guillotine-type. Such plastics tools not only require less time for manufacture, but can be produced for about one-tenth of the cost of the conventional steel type.

In Fig. 1 is shown a plastics knock-out block for use in a trimming die for compressor blades. Such blocks can be made more accurately in plastics than in steel, and, moreover, their cost is approximately 20 per cent of that of the steel tools. In another instance, a fixture was required for holding a turbine blade during accurate stamping operations on the blade side of the platform. A reinforced plastics fixture was used to locate the blade by the dovetail root portion, and to hold it in a vertical position during stamping, and this tool was produced at considerably less cost than would have been required for an equivalent steel tool.

Other plastics tooling equipment which has been used to assist in operations on turbine blades and compressor blades, includes:—tumbling fixtures; polishing blocks; die models; scribing and sawing fixtures; electro-etching marking blocks; grinding fixtures; honing tools; and inspection equipment.

In connection with the inspection operations, difficulty was experienced in checking the internal splines of the partly-machined pinion shown in Fig. 2. This pinion was required for a small gas turbine, and the internal splines could not readily be checked by either optical or mechanical means. Inspection was facilitated by using the part as a mould to produce the plastics casting seen at the upper left, the external form of which could be checked without difficulty. By using a plastics material which has a low coefficient of shrinkage, it was possible to obtain a duplicate of the internally-splined bore to a high degree of accuracy.

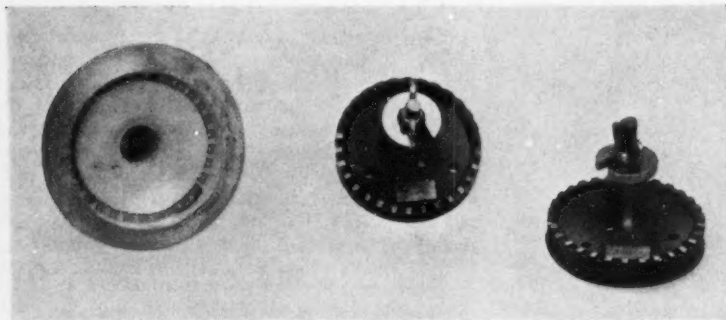


Fig. 3. At the Right are Two Plastics Fixtures for Sub-assembly Operations on Rear Compressor Shafts. The Mould from which They were Made is Seen at the Left



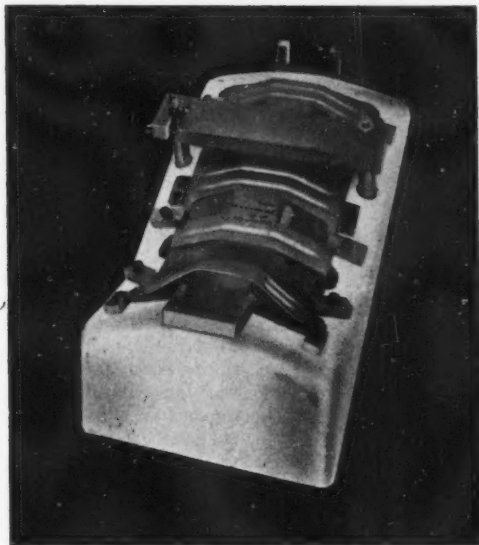
Fig. 4. A Steel Wrench with an Internally-splined Plastics Insert which was Cast from a Production Part

Plastics tools have also been used for sub- and final-assembly operations, and plastics holding fixtures, for sub-assembly operations on compressors, are shown in the centre, and at the right, in Fig. 3. These fixtures were required to facilitate assembly of the rear compressor shaft, and each has a series of radial grooves for locating the workpiece. The mould for producing these fixtures is at the left in Fig. 3. Among the advantages claimed for the use of plastics assembly tools are durability, light weight (approximately one seventh that of steel) and the fact that plastics tools do not damage the workpieces.

Non-standard wrenches are often required for assembly operations and an example of the application of plastics to the manufacture of such tools is given in Fig. 4. The wrench has a steel body with a plastics insert wherein the internal splines were moulded from an actual workpiece. The use of a workpiece as a mould or core often expedites the production of plastics tools, and reduces their cost.

Plastics have also replaced steel for the manufacture of the guide pins used in assembly operations. Formerly, these pins were of 2-piece construction, and each comprised a steel pin and a brass bullet-nose. By making a simple mould, it was found that these pins could be manufactured in plastics for approximately one-fifth of the cost of the metal type.

Plastics tools have been employed for machining and welding operations, and in Fig. 5 is shown a welding fix-



**Fig. 5. A Plastics Fixture Used to Hold Tail-flap Assemblies During a Tack-welding Operation**

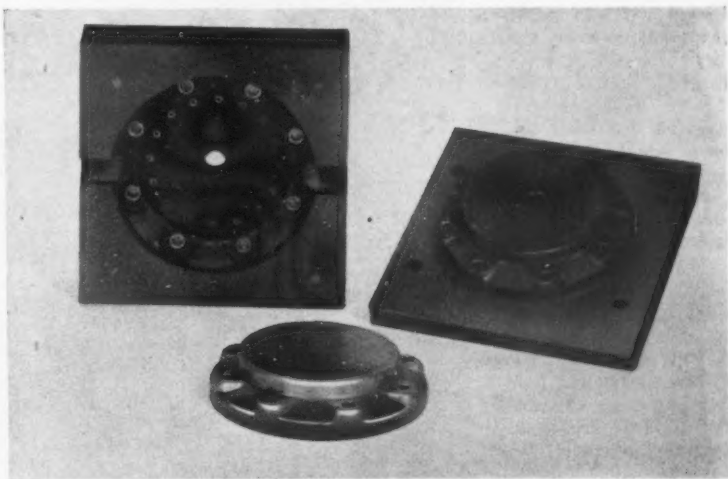
ture which was made quickly and economically for the development of a small quantity of tail-flap sub-assemblies. The main part of this sub-assembly is a sheet-steel flap, which has intricate double contours meeting at an angle. The flap is welded to a pad and a bracket, and the relative positions of the parts have to be maintained within close limits. The complex contours at the angles of the flap were first formed on a prototype part, and checked with the aid of templates. Next, the base of the fixture was moulded from this part, and cored holes were formed in the correct positions for the entry of the tack-welding electrodes, by means of plastics tubing. The fixture was of laminated construction, and was completed by adding stops and clamps where

necessary. It was estimated that a saving in overall cost of approximately 85 per cent was effected by using plastics for this tool, in comparison with conventional methods, and, furthermore, the tool was completed and ready for use in approximately one-fifth of the time which would normally have been required.

When somewhat similar tack-welding fixtures were required, no production or prototype components were available for use in moulding the plastics. For these tools, brass templates were made from the working drawings and were mounted on a baseplate. From this set-up, a model was quickly constructed which facilitated the moulding of the final fixture.

In Fig. 6 is shown a cover which has seven unequally-spaced bosses, and it had to be held rigidly and accurately during drilling operations. A plastics jig was made by using the cover as a mould, and producing a casting of each side. Then, these castings were jig bored and drill bushes were fitted, as may be seen at the upper left and right in Fig. 6. This accurate light-weight drill jig was made for approximately  $\frac{1}{4}$  the cost of an equivalent steel tool.

Initially, in the small aircraft engine department, there was much opposition to the use of plastics tools, since it was generally considered that steel was the only suitable tool-material in view of the heavy loads imposed. However, since plastics dies could obviously be manufactured more cheaply



**Fig. 6. This 2-piece Plastics Jig is Used for Drilling a Number of Holes in the Aluminium Cover Seen in the Foreground. The Latter was Used as a Mould to Produce the Two Jig Members**

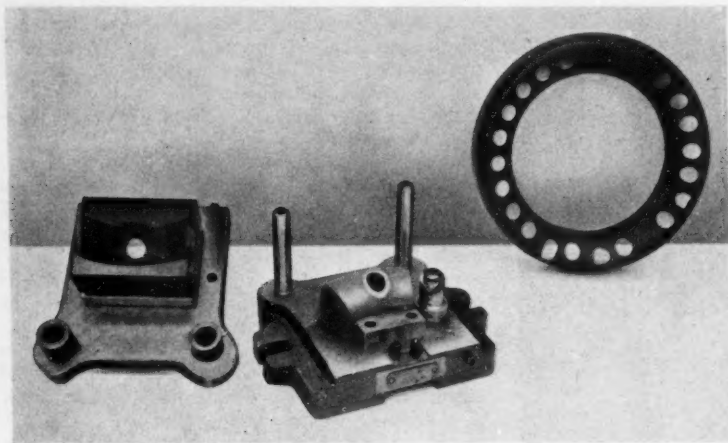


Fig. 7. Plastics Piercing Die for Operations on the Cowl Seen at the Right. This Die Incorporates Steel Inserts

and quicker than steel dies, experimental tooling was made for press and draw-hammer operations.

One of the first plastics dies was for a crimping operation on an outer combustion liner, which, because of the shape required, was quite simple to duplicate. This die was used successfully and was manufactured for 50 per cent of the cost of an equivalent steel die. The die shown in Fig. 7 is used for piercing the sheet-steel cowl seen at the right and, once again, a finished production part was used for moulding the plastics material. A steel punch and bush were inserted into the plastics members before they were mounted in a die set. It was estimated that this die was made for approximately 25 per cent of the cost of a steel tool. In another instance, a plastics die was used for a tube-forming operation. A master part was made and used as a mould for the upper and lower member of the

die, which were then mounted on a flat steel plate. This die was completed in one-tenth of the time, and at 33 per cent of the cost, of an all-steel die.

Finally, attention is drawn to the plastics drop-hammer die seen in Fig. 8, which is used for forming a 0.030- to 0.040-in. thick, stainless steel part. A plastics master was used to produce both the punch and the die, the punch being faced with resilient plastics, and the die with cast plastics. In addition to permitting substantial savings in tool-making costs, the use of plastics enables

the tool to be repaired or modified without difficulty. From the experience gained so far, it would appear that plastics may be applied satisfactorily to the production of drawing and piercing dies, and will be used increasingly in the future.

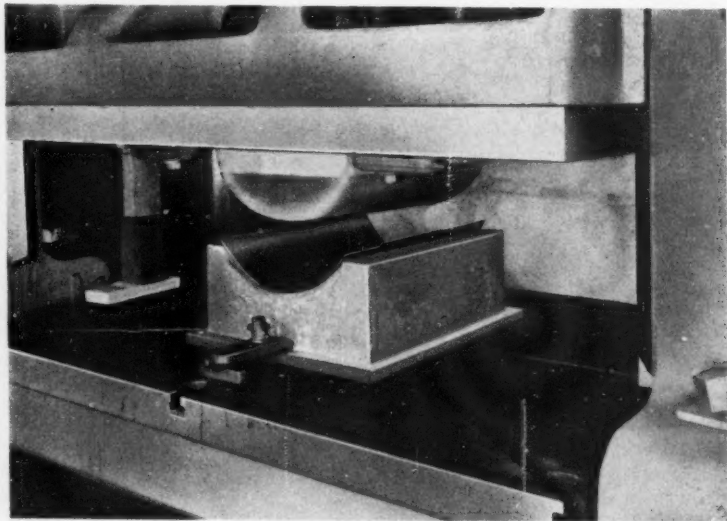


Fig. 8. Forming a 0.030- to 0.040-in. Thick Stainless-steel Part with a Plastics Tool on a Drop Hammer. The Punch has a Facing of Resilient Plastics, and the Die is of Cast Plastics

Plastics tool materials have a number of limitations and disadvantages, including the following:—(1) metal chips can become embedded in the plastics material; (2) when glass-cloth laminate is used, it has a tendency to dull the edges of cutting tools; (3) plastics tools wear quickly unless suitable steel wear-resisting inserts are provided at critical points; and (4) epoxy resins are thermal setting, and cannot be remelted and re-used.

Plastics tool materials offer the following advantages,

in addition to those already mentioned:—(1) the low coefficients of shrinkage and expansion of epoxy plastics allow shapes to be reproduced in these materials to high limits of accuracy; (2) the tensile strength of epoxy plastics can be increased by the use of glass-cloth reinforcement; (3) except for those grades which are very abrasive, epoxy resins can be machined easily; and (4) after curing, epoxy resins are non-toxic and can be bonded to any surface which has been suitably prepared.

## Trade Publications

THE STANDARD & POCHIN BROS., LTD., Evington Valley Road, Leicester. Publication No. 177 gives performance data and dimensional details of the complete range of P.R. Uniform pulley-mounted centrifugal fans, which range in capacity from 200 to 20,000 cu. ft. per min.

WILLIAM GEIPEL, LTD., Vulcan Works, 156/170 Bermondsey Street, London, S.E.1. Illustrated leaflets No. AC201 and AC204 give dimensional details and ratings of the series GL triple-pole A.C. contactors. These contactors are divided into four main classes, based on the frequency of operation, and are available with ratings from 3 to 150 h.p., according to voltage and the duties for which they are required.

HADFIELDS, LTD., East Hecla Works, Sheffield, 9. Illustrated booklet (No. 477) of 23 pages, concerned with the range of components for extrusion presses which is made by this company. There are descriptions of the designs and functions of some of these components, and a section is devoted to specifications of the wide range of Hecla steels which are used in their manufacture.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 51-53 Hatton Garden, London, E.C.1. Illustrated booklet describing a number of industrial applications for the company's metallic flexible armoured cable. Details are included of flexible connections and glands, and of some special types of armoured cable which the company has produced to customers' specific requirements.

WILKINSON (SHUSTOKE), LTD., Thermoflex Works, Shustoke, Coleshill, Birmingham. Leaflet drawing attention to the company's bi-metal products, which include silver on copper for electrical contacts, nickel or nickel-silver on brass for coach beading and similar purposes, Invar on brass (Thermoflex) for thermostatic applications, and Invar on cupro-nickel for higher temperatures, up to 450 deg. C.

VICTOR PRODUCTS (WALLSEND), LTD., G.P.O. Box No. 10, Wallsend-on-Tyne. Re-issue of technical bulletin No. 33, entitled "Water in Air," in which details are given of the company's range of Aridifier equipment, for removing water from compressed air systems. These units, which separate water from air by centrifugal action, have capacities ranging from 2 to 2,100 cu. ft. of free air per min., at various pressures.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., Dawes Road, London, S.W.6. Fully-illustrated brochure, of 24 pages, concerned with the company's range of pneumatic hoists and rams. Sections are devoted, for example, to pendant hoists and trolleys; rams for horizontal, bench, or wall mounting; vertical and inverted, vertical and table top, cushioned, and pivoted rams; multi-purchase hoists; pneumatic bench vices; operating valves; and light type cylinders.

DIAGRIT DIAMOND TOOLS, LTD., Pattenden Lane, Marden, Kent.—Catalogue and price list covering the wide range of metal-bonded diamond wheels and hones made by the company for use in the engineering and allied industries. Dimensional details and recommended diamond grades are given for the wheels and hones, and sections are devoted to the methods of mounting the wheels; suggested spindle speeds and feed rates; types of coolant; cleaning the wheels; and the facilities offered by the company for re-truing and forming.

RENOLD CHAINS, LTD., Renold House, Wythenshawe Manchester. Well-arranged and fully-illustrated catalogue covering the complete range of standard chain drives up to a maximum horse-power of 4,000. Full dimensional details are given of the various sizes of single, duplex, and triple chains, and nomograms are included for determining the numbers of teeth for a given ratio, and the chain length for a given centre distance. A coloured chart indicates the required chain size for a given horse-power and pinion speed.

B.T.R. INDUSTRIES, LTD., Herga House, Vincent Square, London, S.W.1. Conveyor and elevator handbook, of 52 pp., intended for designers of mechanical handling plant and users of conveyor belting. The book describes the various types of natural and synthetic conveyor belts made by the company, and contains a section on those factors of design and maintenance which affect the life of the belt. Such factors include correct installation, safe working stresses, belt wear and capacity, and the effects of various climatic conditions. There is a number of illustrations of industrial applications of B.T.R. belting, including installations in iron and steel works, electricity-generating stations, and gas-producing plants, and for the transport of machine shop swarf.

# News of the Industry

## Manchester and District

**JOSHUA HEAP & CO., LTD.**, Ashton-under-Lyne, are well employed on the production of tangential and radial die-head threading machines, from 1 in. up to 6 in. capacity, for both home and overseas customers. Orders in hand also cover universal and duplex-type machines. We hope, at a later date, to make further reference to a special double-ended machine built for British Railways, for producing the right-and left-hand threads on 2-in. diameter bars for railway couplings. Export orders have recently been received from South Africa, India, Pakistan, Burma, Australia, New Zealand, Canada and Portugal. Ground thread tangential dies are now being produced for Whitworth and Unified threads.

**DAVID BROWN INDUSTRIES, LTD.**, MACHINE TOOL DIVISION, Sherborne Street, Manchester, together with the Huddersfield works of the organization, were recently visited by a party of 15 Polish engineers who saw some of the types of equipment urgently needed for their country's industrial expansion. This reciprocal visit, which followed a visit to Poland by nine British engineers earlier in the year, was organized by the Institution of Production Engineers and the Polish counterpart S.I.M.P.

**Craven, Brothers (Manchester) Ltd.**, Reddish, Stockport, have recently constructed a railway axle journal re-turning and burnishing lathe for the South African Railways in which special provision is made for the removal of wheel boss liners. The machine is capable of re-turning and burnishing, simultaneously, the two outside journals of 3-ft. 6-in. gauge carriage, wagon, bogie and tender wheel sets, and will turn and burnish, one at a time, the inside journals and inside wheel boss faces of locomotive wheel sets. The height of centres is 2 ft. 9 in., and wheel sets up to 5 ft. 3 in. diameter over the flange can be swung. Work from 4 ft. 0 in. to 7 ft. 6 in. long is admitted between centres. Drive may be either by overhead belt to one of the wheel treads, or alternatively, by faceplate. We may make further reference to this machine in a later issue.

**MAIDEN & CO., LTD.**, Hyde, are steadily occupied on orders for bolt and tube screwing machines,

for both the home and export markets, as well as for a variety of threading dies. Other work includes bar tagging machines and bar chamfering machines of various capacities. As was pointed out in MACHINERY, 92/1427—13/6/58, this firm has recently become associated with the Landis Machine Co., U.S.A., and a new United Kingdom company has been formed under the title Landis Machine-Maiden, Ltd.

H. B.

## Yorkshire

**CROFTS (ENGINEERS) LTD.**, Thornbury, Bradford, have recently issued a 36-page booklet in which the firm's wide range of power transmission equipment is illustrated and described. To obviate the need for baseplates and slide rails, shaft-mounted gear units are now being produced. Such a unit is mounted on the driven shaft and an anchored torque reaction bar is provided.

**CARTER GEARS, LTD.**, Thornbury, Bradford, have supplied a copy of their GP/8 folder describing their hydraulic steplessly-variable speed gears, in which the ranges of both A and F type Carter gears are covered, with dimension and rating tables. Information on the auxiliary equipment and reduction gears, which can be supplied for use in conjunction with the variable-speed units, is contained in separate publications.

**BROOK MOTORS, LTD.**, Empress Works, Huddersfield, have recently developed a new C type drip-proof motor of compact design, which incorporates new insulating materials and an improved ventilation arrangement, with the result that the size has been considerably reduced. The cooling air stream is drawn into the ends of the motor, guided by pressed steel air deflectors, which also serve as additional protection for the end windings, and after passing over the windings, is expelled through openings in the yoke casting. A range of motors, similar in appearance except that the shaft extensions are of smaller diameter, is being produced to the NEMA (American) re-rate specification. These motors have Class A insulation and are made for use on 60-cycle supply. They are already being sold in the U.S.A. through the firm's subsidiary company in Chicago, also by their agents in Canada. We hope, later, to publish further details of the motor.

DENFORD SMALL TOOLS (BRIGHOUSE) LTD., Brighouse, have recently introduced the "Viceroy Educator" 5-in. centre metal-turning lathe with fabricated steel cabinet base. It admits 24 in. between centres, has a hollow spindle driven by V-belt from a  $\frac{1}{2}$ -h.p. motor, and can be supplied for screwcutting. Another recent development is the "Viceroy Sharpedge" 16-in. edge tool sharpening machine, which has been specially designed for sharpening plane irons, chisels, and other edge tools. Drive to the 16-in. diameter grinding wheel, which runs at 85 r.p.m., is taken from a  $\frac{1}{2}$ -h.p. motor through chain and sprocket wheels. Oilite bearings are fitted, and the machine stands 36 in. high and occupies a floor space of 19 in. square. We hope to describe both these machines more fully in due course.

H. B.

### **Zeiss Ultraphot Camera Microscope**

Intended for visual observation and photography of microscopic and macroscopic specimens, the Ultraphot type 2 automatic camera microscope, here shown, has been introduced by the West-German firm of Carl Zeiss, for whom Degenhardt & Co., Ltd., 6 Cavendish Square, London, W.1, are the sole representatives in this country.

Illumination of specimens can readily be effected

by light and dark field methods, and phase-contrast technique (which reveals surface depressions and ridges) with trans- or epi-illumination, employing polarized or non-polarized light, can be applied for the study of grain boundary and precipitation phenomena, and deformation processes, for example. If required, the image can be projected on to the hooded ground glass screen seen mounted above the eyepiece tubes.

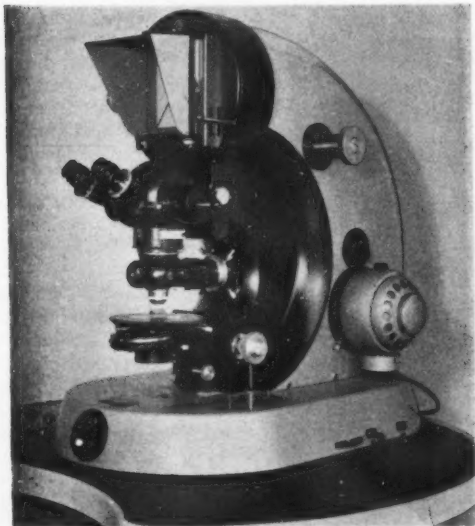
Behind the screen is the camera "photo head" which accommodates 9- by 12-cm. photographic plates and cut film. Alternatively, photo heads to take 13- by 18-cm. plates and miniature film can be fitted. In use, with the specimen illuminated by the low-voltage 100-watt lamp, and with the image correctly focused, the exposure mechanism is set according to the sensitivity of plate in the photo head and the protective cover is slid clear. A push button at the front of the instrument is then depressed. Thereupon, the camera shutter is opened, the exposure time is automatically set by a photo-electric cell to suit the intensity of illumination, and when the appropriate time has elapsed, the camera shutter is automatically closed.

Equipment available includes sliding and rotating stages, an indexing turret-type objective head with capacity for five lens units, and arc and mercury lamps.

One of the instruments has recently been installed at the premises of Padley & Venables, Ltd., Callywhite Lane, Dronfield, Sheffield, where applications will include the inspection of raw material samples and the detection of flaws in the surfaces of steel and tungsten-carbide tools, such as chipping chisels and rock drilling bits.

### **Additional Soag Premises**

Soag Machine Tools, Ltd., whose head office is at Juxon Street, Lambeth, London, S.E.11, have recently acquired large additional premises, approximately 3 miles away, at Hester Road, Battersea, S.W.11. These premises, which include two long bays equipped with overhead cranes of sufficient capacity to provide for movement of the heaviest machines handled by the company, together with smaller bays to be employed as reconditioning shops and for reception and despatch, cover an area of 35,000 sq. ft. The new building, now in use, will supplement the existing facilities at Lambeth and will enable shorter delivery times to be offered. In addition to a representative range of used machine tools, most of which have been fully-reconditioned, a selection of new machines built by the many companies



**Zeiss Ultraphot Type 2 Automatic Camera Microscope**

represented in this country by Soag will be kept on display.

Among various interesting new machine tools seen during a recent "Open House," arranged by the company to enable their customers and friends to familiarize themselves with the new premises, were a Gilly universal horizontal boring machine, a Schmaltz surface grinder, and lathes by Le Progrès Industriel, S.A. Nearly 40 companies are represented and include, in addition to those mentioned, C. Berthiez, Dutranonit ATS, Mondiale, Curd Nube, Rino Berardi, and Wotan-Werke, G.m.b.H. Some new machines are seen on the left in the accompanying illustration which shows part of the new building, and the machines on the right are representative of used equipment. In addition to the sales of new and used machine tools, the company undertakes the reconditioning of customers' machines on site, or in the works at Battersea and Lambeth, as convenient.

The company carries on a large export business and has agents in most European countries and in the Commonwealth. Its name, incidentally, was formed from that of the founder firm, Sonnenberg, A.G., and is shared with the Soag Machinery Co., set up in 1937 to handle printing and packaging machines, which has head offices at the Lambeth address. One of the more interesting orders lately executed by Soag Machine Tools, Ltd., was the supply of a large Craven lathe of 48½-in. centre height, capable of accepting work up to

98 ft. long between centres, and with a driving motor of 120 h.p., to a leading shipbuilding firm in Newcastle. The headstock for this machine weighs more than 70 tons and was recently despatched by road from the new works.

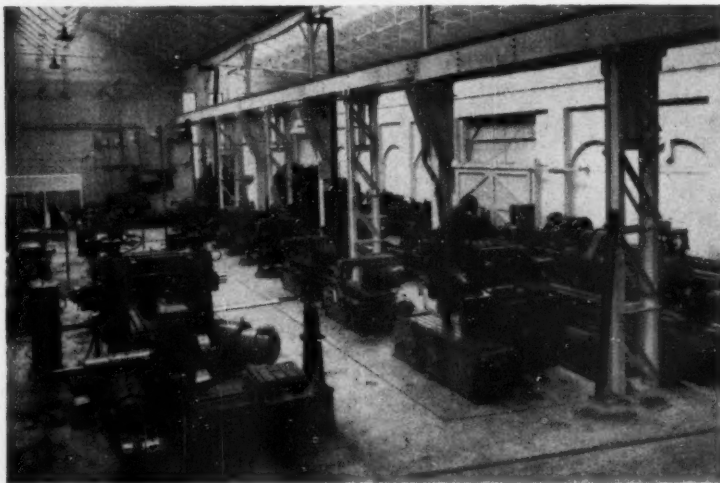
### **Perkins 1.6-litre Diesel Engine**

Founded in 1932 for the purpose of building lightweight, high-speed, diesel engines, F. Perkins, Ltd., Peterborough, Northants, have since become well known as successful manufacturers of these units, the production of which, on machine tools and equipment of modern design, has already been described at length in *MACHINERY*.

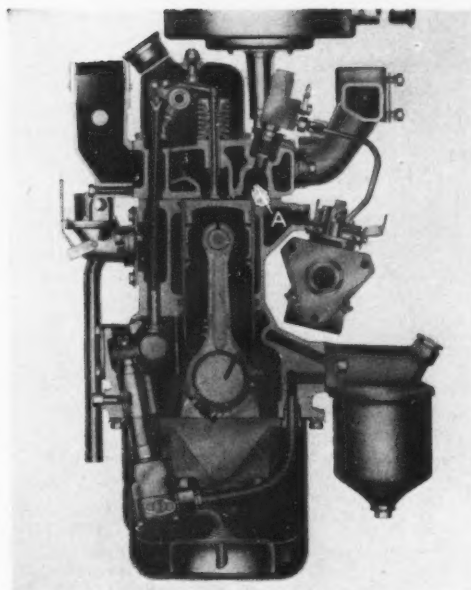
In 1952, the company decided to extend the range of 3-, 4-, and 6-cylinder engines then being produced in sizes from 18 to 100 h.p., and development work was begun on a 4-cylinder, 4-stroke, water-cooled engine of compact in-line design. This engine, which, for a diesel unit, is claimed to be particularly smooth running and quiet in operation, is now being put into production.

Known as the Four 99 (99 cu. in. capacity), the engine weighs only 320 lb., without accessories, and it has a compression ratio of 19 to 1. The bore and stroke are 3 and 3½ in. respectively, and the type supplied for duty in passenger cars has a maximum output of 45 b.h.p. at a speed of 4,000 r.p.m. An engine is also available for industrial use in fork-lift trucks, cranes, pumping sets, and compressor equipment, for example, and in this form it develops a maximum of 35 b.h.p. at a speed of 3,000 r.p.m. At 2,000 r.p.m., the normal maximum torque obtained is 60 lb.-ft.

A feature of the design is the patented system of combustion. The upper portion of the combustion chamber is hemispherical and is incorporated in the cylinder head, and the lower part of the chamber is closed by a threaded insert with an oval bore, through which air flows from the cylinder. Fuel is injected into the chamber from



**A General View in the Battersea Premises Recently Acquired by Soag Machine Tools, Ltd., for Storage, Reconditioning and Display of New and Used Machine Tools**



**Cut-away View of Perkins Four 99 1.6-litre Diesel Engine**

the top. During the greater part of the compression stroke, air is transferred vertically and moves across the nozzle to produce swirl. Later, the direction of flow from the cylinder becomes horizontal, and finally, when combustion is about to begin, violent air movement takes place, which promotes extreme turbulence so that the fuel and air are thoroughly mixed. A cut-away view of the engine is shown in the illustration, where the combustion chamber is indicated at A.

Of high-duty cast iron, the camshaft has chilled cams and is supported in three bearings in the cylinder block, which is fitted with wet liners of centrifugally-cast iron. En. 18s chromium steel is employed for the inlet valves, and En. 52 silicon chromium steel for the exhaust valves. Supported in three bearings of the steel-backed, lead-bronze type, the crankshaft is machined from an En. 19T chrome molybdenum steel forging, and the journals are induction hardened. Connecting rods of high-tensile steel carry pistons of high-silicon aluminium alloy, each of which is fitted with three compression rings and two scraper rings.

For the transport applications, the outstanding features claimed for the engine are fuel economy and long life. It is stated that a Bedford motor

van with a 15-cwt. load travelled a distance of over 100,000 miles on the M.I.R.A. testing track at Lindley at a speed of 56 m.p.h., with a fuel consumption of 37 m.p.h. A Ford Consul Mark II car fitted with the Four 99 engine was subjected to an R.A.C.-observed test over a distance of 218 miles. The average speed, inclusive of stops due to traffic conditions, was 34.8 m.p.h., and fuel consumption 50.8 m.p.g. Engines can also be supplied for fitting in Vauxhall Velox and Wyvern cars, the Austin Omnivan and the Morris J2 van, and other conversion arrangements are being developed.

### **Electrical Machining**

*(Continued from page 1491)*

Of a very different nature is the technique of drilling holes and machining slots by means of an electron beam, to which Mr. Rudorff drew attention. For this purpose the electron beam, produced by thermionic emission, is accelerated and focused magnetically and it was stated that holes of 0.1 to 0.001 mm. diameter could be rapidly formed in tungsten, glass, or porcelain plates ranging in thickness from 3 mm. to 0.1 mm. A disadvantage of the process is that the work must be introduced into a high-vacuum chamber, but this drawback should be more than offset, where very small holes must be produced, by the rapidity of penetration.

Finally although it cannot perhaps be properly regarded as an electrical machining process, reference may be made to tungsten arc cutting which was briefly discussed in another paper—by Mr. G. Sims-Davies, M.I.Mech.E.—presented at the same conference. By this method, aluminium plate up to 1½ in. thick may be rapidly cut, and the edges are comparable to those obtained with the oxy-acetylene cutting of steel. In addition, good results have been obtained with copper, brass, and stainless steel plate.

It will thus be evident that electrical power may be directly applied for metal removal in a diversity of ways which are likely to assume increasing importance in the future, as the ranges of work materials and forms confronting the production engineer continue to expand.

### **Initial Allowances**

The Chancellor of the Exchequer recently announced in the House of Commons that it was proposed to raise the initial allowance on plant and machinery to 30 per cent and on industrial buildings to 15 per cent. These allowances previously stood at 20 per cent and 10 per cent respectively, and the last Budget provided for increases to 25 per cent and 12½ per cent. The revised allowances will date from Budget day.

## Industrial Notes

**SHEEPBRIDGE ALLOY CASTINGS, LTD.**, have appointed **E. H. Bennet & Son**, 124 Seymour Place, London, W.1, as their Southern Area representatives.

**THE ENGLISH ELECTRIC CO., LTD.**, inform us that their Birmingham branch has moved to larger premises at Pitmaston, Moseley, Birmingham 13 (telephone number, South 4021/5).

**SILVERCROWN, LTD.**, have opened a depot at South Road, Trafford Park, Manchester, 17 (telephone number, Trafford Park 0401) for the supply of their electroplating chemicals and equipment in the North Western area.

**HIGH DUTY ALLOYS, LTD.**, Slough, Bucks., inform us that the address of their Scotland and Northern Ireland sales office has been changed to Atholl Avenue, Hillington, Glasgow, S.W.2.

**AN AUCTION SALE OF VEHICLES, MACHINE TOOLS** and miscellaneous stores will be held at Central Ordnance Depot, Bicester, Oxon., on July 15 and 16. The auctioneers will be Midland Marts, Ltd. (Dept. N), Market Square, Bicester.

**HONEYWELL-BROWN, LTD.**, inform us that the name of the company has been changed to **HONEYWELL CONTROLS, LTD.**, and that all head office departments and the London branch office have moved to Ruislip Road East, Greenford, Middlesex.

**YORKSHIRE ENGINE CO., LTD.**, Sheffield, a branch of the United Steel Companies, Ltd., announce that they have received an order, valued at £350,000, for the supply of 16 diesel-electric shunting locomotives to the Port of London Authority.

**THE DOWTY GROUP** announce the formation of a new company, known as the Dowty Mining Developments, Ltd., Ashchurch, Nr. Tewkesbury. This new company will specialize in the supply of hydraulic pit props and Roof-master self-advancing supports, which have been handled hitherto by Dowty Mining Equipment, Ltd.

**KLAXON, LTD.**, 49 Upper Brook Street, London, W.1. Reference was made in *MACHINERY*, 92/1420—13/6/58, to this company's motors and it was stated that the range covered horse powers from 1/100 to 1. We are asked to point out that the range, in fact, extends down to 1/2000 h.p.

**MACHINE TOOL ORDERS IN MARCH** were valued at £6,425,000, of which £1,832,000 was for export. Deliveries during the month amounted to £8,304,000 (including £2,104,000 was for export). At the end of March, the total of orders in hand was £70,464,000, including £18,148,000 for export.

**FERRANTI, LTD.**, Hollinwood, Manchester, have supplied a Pegasus electronic digital computer to the University of Stuttgart, Germany, for use, initially, in research work on

nuclear physics, aerodynamics, and the design of precision instruments. The staff who will operate this machine are being trained at the London computer centre.

**HEPWORTH & GRANDAGE, LTD.**, St. John's Works, Bradford, are to establish a £2,000 trust to provide prizes for successful students in the Diploma of Technology courses which are arranged by the Bradford Institute of Technology. These awards, which will probably be known as the Elijah Hepworth Memorial Prizes, are likely to number three or four each year.

**E.M.I. ELECTRONICS, LTD.**, Blythe Road, Hayes, Middx., have received an order for one of their latest unit-construction analogue computers from Sir W. G. Armstrong Whitworth Aircraft Co., Ltd. The computer is to be installed at the latter company's Whitley works, and will be used for studying guided weapon and aircraft systems whilst they are still in the design stage.

**GLOBE PNEUMATIC ENGINEERING CO., LTD.**, have developed a new pneumatic winch. Particularly intended for use in connection with large constructional undertakings, nuclear power stations, and steel erection work, the winch is powered by a Globe 10-h.p. radial air motor and has a lifting capacity of three tons. An automatic brake is incorporated, and the average rate of lift is 50 ft. per min.

**CAUSEWAY REINFORCEMENT, LTD.**, 66 Victoria Street, London, S.W.1, report that their Hexmetal cellular reinforcement is being increasingly employed in the construction, for example, of blast furnaces, dust collectors, and sinter and coke bunkers. This steel honeycomb cell material may be loaded with cement or refractory to provide a lining which is resistant to temperature variation, abrasion, vibration, corrosion, and impact loads.

**THE AMERICAN SOCIETY OF TOOL ENGINEERS**, 10700 Puritan, Detroit 38, Mich., U.S.A., announce that the Western Tool Show, which will be held in conjunction with their semi-annual meeting at the Shrine Exposition Hall, Los Angeles, from September 29 to October 3, will have the theme "Tooling for the Space Age." It is stated that 65 per cent of the display area has already been reserved.

**SPECIALLOID, LTD.**, 20 Black Bull Street, Leeds 10, who recently acquired a controlling interest in Powder Couplings, Ltd., are to start the manufacture of powder-type couplings. These couplings will be of various designs, including one type which can be used for both pulley and in-line drives. As from July 1, all enquiries relating to the manufacture, servicing, or sale of these units should be directed to Powder Couplings, Ltd., at the above address.

**CHANCE BROTHERS, LTD.**, Smethwick, Birmingham, are offering sets of test glasses, for use by suppliers of welding protection equipment in determining the most suitable filter for use in connection with a specific welding

operation. The sets consist of cards and wallets containing a total of seven Protex glasses, suitable for electric welding, and eight Protal and Protex glasses for gas welding, with or without the use of flux. All the glasses conform to British Standard specifications.

SHORT BROS. & HARLAND, LTD., Belfast, announce that they have acquired the British Straddle Carrier Co., Ltd., with all manufacturing and marketing rights. The name of the latter company will not be changed, but all manufacturing activities will be controlled by the headquarters of Short's General Engineering Division at Newtownards near Belfast. Sales distribution and service will be carried out from East India House, Regent Street, London, W.1.

NEWMAN INDUSTRIES MACHINE TOOL DEMONSTRATION.—A demonstration of machine tools has been arranged by Newman Industries, Ltd. (Machine Tool Division), at the premises of Sivewright Transport and Storage, Ltd., Taylor Road, Trafford Park, Manchester, on July 9 and 10 from 10 a.m. to 4 p.m. each day. Among the interesting machines to be exhibited is a new Heid copying lathe, which will be seen in operation, turning an intricate work-piece with a length of 7½ ft. This machine has several important features, including variable centre height, and a talk will be given by a representative of the Heid works. Further details may be obtained from Newman Industries Ltd., Machine Tool Division, Yate, Bristol.

AERO RESEARCH, LTD., Duxford, Cambridge, inform us that, from June 30, 1958, their name will be changed to CIBA (A.R.L.), Ltd. Names of proprietary products such as Aerolite, Araldite and Redux will still be used. The company was founded in 1934 to carry out research into aircraft structures and to develop new adhesives, but during the past 20 years the range and extent of its activities have changed so that the original name is no longer appropriate since so many industries are now using its products. The new name will also serve to emphasize the affiliation of the company to the CIBA organization which has had almost 75 years of experience in chemical manufacture, operates on a world-wide scale, and produces materials for the dyeing, textile, pharmaceutical and plastics industries.

### New Film on Saroy Plastics Sheeting

A second film concerned with Saroy extruded high-impact polystyrene sheeting has recently been produced by Saro Laminated Wood Products, Ltd., Whippingham, East Cowes, Isle of Wight. This film describes the manufacture of the raw polystyrene by a polymerization process, and shows how the resulting material is blended with pigments, formed into thin continuous strands, and then cut into small pellets. The latter are fed, by means of an air lift arrangement, to the delivery hoppers of extruding machines, and sheets extruded from the dies finally pass through finishing rolls, which are maintained at a constant temperature by circulated hot water.

Views are included of a variety of vacuum forming operations on finished sheets to produce, for example, refrigerator inner-lining members, food containers, children's baths and toys, and hulls for model yachts.

### Investment Casters' Association

A new technical association has been formed, under the title of The British Investment Casters' Technical Association, to cater for the needs of the branch of the foundry industry that uses expendable pattern techniques for the production of industrial metal castings. The new association will be concerned with the technical aspects of investment casting, and its activities will include the preparation of specifications for materials and testing procedures, the improvement of production techniques, the expansion of the application of investment castings, and the general exchange of technical information within the industry.

The inaugural meeting of the Association was held in London on June 11, and was attended by representatives of 25 companies. At this meeting the following were elected as Members of Council:—Mr. D. H. Armitage [P.I. Castings (Altrincham), Ltd.], chairman; Mr. R. W. N. Danielsen (Deritend Precision Castings, Ltd.); Mr. W. Foyers (H & F Precise Castings, Ltd.); Mr. G. A. Tomkinson (D. Napier & Son, Ltd.); and Mr. N. Walker (Hadfields, Ltd.).

Through the courtesy of the British Steel Castings Research Association, the address of the new association is 5 East Bank Road, Sheffield, 2 (telephone number Sheffield 28647), and the secretary is Mr. J. Bolton to whom all enquiries and applications for membership should be addressed.

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27/6/58

## Personal

SIR HERBERT BRITTAIN has been appointed chairman of the Iron and Steel Holding and Realization Agency in succession to the late Sir John Morison.

SIR ARCHIBALD FORBES, chairman of the Iron and Steel Board, has been appointed a director of the Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham.

MR. JAMES A. DEWHIRST has been appointed director and general manager of Midgley & Sutcliffe, Ltd., Leeds, in succession to Mr. Gordon Haithwaite, who has resigned.

MR. E. SEYMOUR-SEMPER, M.I.Mech.E., F.R.S.A., M.S.E., M.Inst.W., director of Hancock & Co. (Engineers), Ltd., Progress Way, Croydon, has been elected President of the British Acetylene Association.

MR. N. ROLASTON has been appointed a director of B.I.P. Tools, Ltd., 147 Tyburn Road, Erdington, Birmingham. He was formerly chief draughtsman of the company, and, subsequently, development engineer.

MR. L. CLEMENTS, export manager of Ferodo, Ltd., Chapel-en-le-Frith, Stockport,<sup>1</sup> has retired after 39 years' service. He has been succeeded by Mr. J. C. T. Fell, who joined the company in 1950.

MR. H. W. BOYNE has joined the staff of Colloidal Graphite, Ltd., 6/7 St. Dunstan's Lane, London, E.C.3, as technical sales representative. He was formerly home sales manager for Arthur Balfour Co., Ltd., Sheffield.

VICE-ADMIRAL SIR FRANK MASON, K.C.B., M.I.Mech.E., M.I.Mar.E., has been appointed chairman of the Mechanical Engineering Research Board, in succession to Sir Andrew McCance, F.R.S., who has retired.

MR. PAUL GRANBY, managing director of Paul Granby & Co., Ltd., 39 Victoria Street, London, S.W.1, is now in the U.S.A. where he is studying the latest developments in the cold impact extrusion of steel.

MR. J. RUSSELL HICKMOTT, A.M.I.B.A.E., has been appointed the London manager for Perkins C.M.E., Ltd., Mansfield Road, Derby, and will occupy temporary offices at 83 Cromwell Road, London, S.W.19. The London showrooms of this company will be opened shortly.

MR. B. L. SCOTT, B.Sc., A.M.I.E.E., has been appointed manager of the Newcastle-upon-Tyne branch of George Ellison, Ltd., Perry Barr, Birmingham, 22B, in succession to Mr. J. GIBBINS, who has retired after 46 years' service with the company.

MR. S. M. MAUDE, who lectures on production engineering at Keighley Technical College, has been appointed works manager of Anderton Springs, Ltd., Clyde Street, Bingley, Yorks., and Dee-Kay Engineering Co., Ltd., Victoria Works, Bingley, Yorks.

LT.-CDR. G. W. WELLS, D.L., has been appointed managing director (production) of the United Steel Companies, Ltd., 17 Westbourne Road, Sheffield 10. He will continue to hold the position of general manager of Appleby-Frodingham Steel Company, Scunthorpe, a branch of the former company. Consequent on the above

appointment, Mr. A. JACKSON will be relinquishing his position of general works manager of Appleby-Frodingham in order to take up an appointment as technical adviser on steel manufacture to the United Steel Companies, Ltd. Mr. Jackson will still retain his directorship of Appleby-Frodingham, but will now become a technical director of that company. Mr. J. D. JOY has been appointed a director and general works manager of the Appleby-Frodingham Steel Company, and will relinquish his position as general manager of Samuel Fox & Co., Ltd.

## Scrap Metals

↑LONDON.—Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £152; clean heavy copper, untinned and free from lead and solder, £147; second grade copper wire, £142; clean light copper, £137; brazing copper, £124; gunmetal, £126; brass mixed, £93; lead, net, £59; zinc, £28; cast aluminium, £82; old rolled aluminium £107; battery lead, £32; unsweated brass radiators, £76; hollow pewter, £495; black pewter, £365

MIDLANDS.—The slump in ferrous scrap trading continues and merchants are hard pressed to find outlets for the material forthcoming from Midland factories. Many grades are being stored in yards, but the position is now reaching a point where further tonnages cannot be put down due to lack of space, as well as for financial reasons.

Offers for scrap have fallen considerably and in some instances merchants have found it necessary to refrain from renewing existing contracts. The allocations from steelworks, blast furnaces and foundries are being further reduced as the holiday season approaches, and with the news that May steel output was down, it is anticipated that complete stoppages will soon be in force.

Light iron scrap and bushy turnings are already being tipped in the Midlands, as rubbish, since merchants cannot place even odd loads at any price. Output of light steel cuttings is high, but with the sale of compressed bundles restricted merchants find it very difficult to maintain clearances.

Tenders in circulation in respect of special scrap supplies are frequently being returned "no quote," as merchants feel that their responsibility to clear works productions takes precedence.

All grades are difficult to move, and there is no indication of improvement in the position until the Autumn.

Current maximum control prices, delivered consumers' works, are now: •Heavy steel No. 1, 217s. 6d.; •heavy steel No. 2, 196s.; •heavy steel No. 4, 207s. 6d.; •heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

\* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.

† George Cohen, Sons & Co., Ltd., 600 Commercial Road, E.14.

‡ Subject to market fluctuations.

## Machine Tool Share Market

Stock markets displayed firmness over the past week. Prices advanced steadily in most sections, and there was some expansion in the volume of business. Sentiment improved as a result of the proposal to raise initial allowances for plant, machinery and industrial building, also the reduction in Bank Rate from 5½ per cent to 5 per cent.

British funds, also home corporation and dominion stocks, were well supported, and closed the week on a strong note, with a general rise in values.

The commercial and industrial sections, after a quiet and irregular period, became fairly active and cheerful. Share prices advanced as a result of selective demand, and by the end of the week a number of substantial gains had been recorded.

Among machine tool issues, Edgar Allen advanced 6d. to 27s. 9d.; Asquith Machine Tool, 7½d. to 18s. 9d.; British Oxygen, 2s. to 35s.; Chas. Churchill, 1½d. to 4s. 7½d.; Churchill Machine Tool, 4½d. to 17s. 9d.; Alfred Herbert, 1s. 3d. to 33s. 9d.; Modern Engineering, 3d. to 8s. 9d.; John Shaw & Sons (Wolverhampton), 3d. to 12s. 6d.; Ambrose Shardlow, 6d. to 37s. 6d.; and Scottish Machine Tool, 6d. to 5s. On the other hand, F. Pratt lost 7½d. at 20s. 7½d.

ASQUITH MACHINE TOOL CORPORATION LTD.—Interim dividend 10 per cent.

KENDALL & GENT LTD. Interim dividend 5 per cent (same).

NEWALL ENGINEERING CO., LTD.—Dividend 15 per cent for the year ended March 31 last, plus a capital distribution of 5 per cent, tax free, out of realized capital profits.

SCOTTISH MACHINE TOOL CORPORATION LTD.—Final dividend 9 per cent, making, with the interim, a total distribution of 12 per cent for the year (same).

## Mercer Centenary Dinner

In connection with the centenary celebrations of Thomas Mercer, Ltd., Eywood Road, St. Albans, Herts, a dinner was held recently at the Connaught Rooms, London, and the company reflected the firm's interests and accomplishments in the fields of horology and metrology. Mr. R. H. Buckland ably paid tribute to the personality and abilities of the chairman, Mr. Frank Mercer, who responded with some recollections of great interest. The toast of Thomas Mercer, Ltd., was proposed by Mr. M. L. Bateman and Mr. T. G. Mercer replied in light-hearted vein.

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.	Harper (John) & Co., Ltd.	Ord.	5/-	13/3
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	8/3	"	4½% Red.	£1	13/1½
Allen (Edgar) & Co., Ltd.	Ord.	£1	27/3	"	Cum Prf.		
"	5% Prf.	£1	14/9*	Herbert (Alfred), Ltd.	Ord.	£1	33/9
Arnott & Harrison, Ltd.	Ord.	4/-	13/6	Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	18/9	"	"B" Ord.	5/-	9/9
"	6% Cum. Prf.	£1	18/6	Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/-	"	7% Cum. Prf.	5/-	5/-
"	5% Cum.	£1	15/3	Kayser, Ellison & Co., Ltd.	Ord.	£1	44/6
"	6% Cum.	£1	17/6	"	6% Cum. Prf.	£1	18/-xd
"	"B" Prf.			Kendall & Gent, Ltd.	Ord.	5/-	7/7½xd
"	4% 1st Mort.	Stk.	85/-	Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3
British Oxygen Co., Ltd.	Ord.	£1	35/-	Kitchen & Wade, Ltd.	Ord.	4/-	10/-xd
"	6½% Cum. Prf.	£1	21/3	Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/7½	Massey, B. & S., Ltd.	Ord.	5/-	7/9
Broom & Wade, Ltd.	Ord.	5/-	10/4½xd	Modern Engineering Machine Tools Ltd.	Ord.	5/-	8/9
"	6% Cum. Prf.	£1	17/9	Newall Engineering Co., Ltd.	Ord.	2/-	4/6
Brown (David) Corporation Ltd.	Ord.	£1	14/-	Newman Industries, Ltd.	Ord.	2/-	2/3
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9	"	6% Prf. Ord.	5/-	5/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	5/6	"	Ord.	2/-	2/9
"	5% Cum. Prf.	£1	13/9	Osborn (Samuel) & Co., Ltd.	Ord.	5/-	17/-
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red.	£1	13/9xd	"	5½% Cum. Prf.	£1	25/3
"	Cum. Prf.			Pratt (F.) & Co., Ltd.	Ord.	5/-	20/7½
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/7½xd	Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/-
"	6% Cum. Prf.	£1	26/3	"			
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/9	Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	37/6xd
"	6% Cum. Prf.	£1	18/6	"			
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/3	Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	12/6
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/10½	Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	33/9
"	4½% Cum. Prf.	£1	14/6	"	5% Cum. Prf.	£1	15/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/9	"	Ord.	5/-	5/9
"	5% Cum.	£1	16/3	"	Ord.	5/-	7/6
"	Red. Prf.			"	4½% Deb.	Stk.	82/-
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/9	"	1961-1977		
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/7½	"	Ord.	10/-	18/6
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/9	Wadkin, Ltd.	Ord.	£1	75/-
"	4½% Cum. Prf.	£1	13/9	Ward (Thos. W.), Ltd.	Ord.	£1	15/9xd
"	Ord.			"	5% Cum.		
Export Tool & Case Hardening Co., Ltd.	Cum. Prf.	2/-	1/3	"	1st Prf.		
"	Ord.			"	5% Cum.	£1	24/6xd
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-	"	2nd Prf.		
Greenwood & Batley, Ltd.	Ord.	£1	46/10½	Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error.

\* Sheffield price.

† Birmingham price.

# PRICES OF MATERIALS

All prices per ton except where otherwise stated.

## Pig-Iron

### Foundry and Forge No. 3, Class 2

Middlesbrough zone £21 6 0

Birmingham £20 18 3

Phos. 0-1 to 0-75% £23 17 0

Birmingham £23 17 0

### Scottish Foundry

Grangemouth £25 3 6

### Hematite

#### English No. 1

N.E. and N.W. Coast £25 6 6

Scotland £25 13 0

Sheffield £26 15 0

Birmingham £27 4 0

Welsh £25 6 6

## Steel Products

Medium plates £45 11 6

Mild steel plates, ordinary\* £42 2 0

Boiler plates\* £44 12 0

†Flat bars 5 in. wide and under £40 0 6

†Round bars under 3 in. £32 15 6

Billets, rolling quality, soft U.T. £32 15 6

## Phosphor Bronze

Ingot (288) (A.I.D.) d/d £252 0 0

## Copper

Cash (mean) £194 12 6

Cold rolled and hot rolled sheets

4 ft. by 2 ft. by 10 SWG £264 5 0—£264 10 0

Rods  $\frac{1}{2}$  in. to  $\frac{3}{4}$  in. diam. £284 5 0

Tubes,  $\frac{1}{2}$  in. bore by 10 SWG, £284 5 0

ton lots, per lb. 2s. 8½d.

Wire rod, black, hot-rolled ( $\frac{1}{4}$ - $\frac{1}{2}$  in.)

English £210 12 6

## Zinc

Refined, minimum 98 per cent. purity,

current month (mean) £65 5 0

## Brass

Tubes, solid drawn, per lb. 1s. 4½d.

Strip 63/37, 6 in. by 10 SWG coils,

ton lots £222 15 0—£225 5 0

Rods,  $\frac{1}{2}$ -3 in. diam. (59 per cent

copper) 1s. 9½d.

## Yellow Metal

Condenser plates, per ton £160 0 0

Rods, per lb. 1s. 10½d.

## Aluminium

Ingot min. 99-5 per cent

Canadian d/d £180 0 0

## Lead

Refined, minimum 99-97 per cent

purity, current month (mean) £74 2 6

## Tinplates

‡U.K. Home trade:

Handmill f.o.t. makers' works £3 11 8½

Cold reduced, f.o.t. makers' works £3 7 4½

U.K. Export:

Hot rolled basis, f.o.t. works' port 74s. 0d.—75s. 0d.

Cold reduced basis, f.o.t. works' port 75s. 0d.

## Gunmetal

Ingot, 85.5.5.5. ex works £168 0 0

\* N.E. Coast, N. Joint Area, Central

Scottish Zone.

† U.T. soft basic.

‡ Official maximum price, after allowing for

adjustments for increase in price of tin.

## MAKERS' PRICES

### Hexagon Steel Bars<sup>1</sup>

Sizes in inches from 1 in. up

to 2-2½ and 2-4½ a/f, ex works

2 ton basis £42 17 0

Free cutting black £47 6 6

### Reeled Steel Bars<sup>1</sup>

Single-reeled  $\frac{1}{2}$  in. upwards,

f.o.t. works (+ usual extra

for sizes) £43 9 6

Free cutting £47 19 0

### High-Speed Steel

Black random length bar. All

prices basic, per lb., subject to

extras.

Molybdenum "66" 5s. 10½d.

Molybdenum "46" 5s. 8½d.

14 per cent tungsten 5s. 9d.

16 per cent tungsten 6s. 1½d.

18 per cent tungsten 6s. 4d.

22 per cent tungsten 7s. 5d.

5 per cent cobalt 9s. 6d.

4-75/5-25 per cent molybdenum

+ 6-0/6-75 per cent tungsten +

1-75/2-05 per cent vanadium

(5-6-2) 6s. 0½d.

### Precision-ground, High-speed

#### Free-turning Brass Rod<sup>1</sup>

$\frac{1}{8}$ -in. dia.  $\pm$  0-00025-in. 2-ton

lots, per lb. 2s. 2½d.

### Grey Iron Rod

Die Cast<sup>2</sup> in random lengths

18 in. to 26 in. rough machined

$\frac{1}{8}$ -in. above listed size. Extra

for definite lengths. Dis-

counts for orders over £150.

Per cwt. net.

Mark I Mark III

$\frac{1}{2}$  or  $\frac{3}{4}$  in. 245s. 4d. 318s. 10d.

1 or  $\frac{1}{2}$  in. 196s. 4d. 251s. 10d.

$\frac{1}{4}$  to  $\frac{1}{2}$  in. 137s. 10d. 171s. 2d.

$\frac{1}{8}$  to 2 in. 106s. 2d. 125s. 1½d.

2½ to 3½ in. 91s. 6d. 106s. 4d.

3½ to 12 in. 86s. 6d. 99s. 2d.

### Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in.

dia. + 0-010 to 0-020 in., prices as quoted

for die cast bar<sup>1</sup>

6-ft. lengths

centreless ground  $\frac{1}{2}$  or  $\frac{3}{4}$  in. 245s. 4d.

+ 0-010 in. Extra 1 or  $\frac{1}{2}$  in. 196s. 4d.

for hardenable

alloy iron<sup>4</sup>  $\frac{1}{2}$  to  $\frac{1}{2}$  in. 137s. 10d.

Per cwt. net  $\frac{1}{4}$  to 2 in. 106s. 2d.

2½ to 3½ in. 91s. 6d.

### Stellite<sup>5</sup>

#### Welding Rods plain

$\frac{1}{8}$  in. dia. per lb. 30s. 0d.

#### Toolbits

$\frac{1}{2}$  in. sq. x 4 in., each 22s. 3d.

### Precision-ground Mild Steel<sup>1</sup>

1-in. dia. + 0-00025-in.

4-ton lots, per cwt. 121s. 6d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor

Street, London, W.1. 2 Pratt, Levick & Co.,

Ltd., Chester. 3 Sheepbridge Alloy Castings,

Ltd., Sutton-in-Ashfield. 4 "Flocast" Harold

Andrews Sheepbridge, Ltd., Malesowen.

5 Deloro Stellite, Ltd., Highlands Road,

Shirley, Solihull.

## BASIC PRICES FROM LONDON STOCK<sup>1</sup>

### Free Cutting Steel

Bright cold drawn:

(Usaspeed) over  $\frac{1}{4}$  to 2 in. £59 17 6

Lead bearing (Usaled) £64 4 0

Precision ground,  $\frac{1}{2}$  in. £81 12 6

### Bright Drawn

M.S. bars (M.M.C.) over  $\frac{1}{2}$  in.

to 2 in. £55 3 6

Square edge flats (Usafat) £72 0 0

M.S. angles (Usaspeed) £99 10 0

Casehardening (EN) (Usacase)

over  $\frac{1}{2}$  to 2 in. £63 9 6

M.S. bars (EN3B) (Usamild)

over  $\frac{1}{2}$  to 2 in. £57 3 6

Carbon manganese semi-freecutting

case hardening (EN202) (Usaspeed

202) over  $\frac{1}{2}$  to 2 in. £72 19 0

35/45 ton tensile (EN6) (Usen)

over 1 to  $\frac{1}{2}$  in. £64 17 6

0-4 Carbon Normalised (Usaspeed

"40") over  $\frac{1}{2}$  in. to 2 in. £66 19 6

Carbon manganese steel to Specifi-

cation EN.16.T (Usaspeed

5565), per ton £127 11 3

### Ground Flat Stock

18-, 24-, and 36-in. lengths (Usa-

speed). List prices less 5 per cent

### Oil Hardening Cast Steel

Non-shrink (Usaspeed N.S.O.H.)

$\frac{1}{2}$  in. to 2½ in., per lb. 1s. 1½d.

Non-distorting heavy duty

(Usaspeed H.C.H.C.)  $\frac{1}{2}$ -in.

to 2½-in., per lb. 4s. 2d.

### Silver Steel

(0-194-in. to 1½-in.)

Genuine Stubbs quality, per lb. 4s. 6d. less 27½%

M.M.C. quality, per lb. 2s. 5d. + 6½%

Boxes of 16 assorted sizes  $\frac{1}{8}$ -in.

to  $\frac{1}{2}$ -in. dia. 7s. 6d.

### Stainless Steel

K.E. 40.AM (Freecutting), per lb. 3s. 3½d.

### Glacier Machined Bronze Bars

Phosphor bronze (288) } Prices on

Lead bronze } application

### High-speed Steel

18 per cent tungsten. Prices on application.

Toolholder bits:

Usaspeed "Super" } List price

" "Supreme" }

" "Cobalt 10 }

### Shimstock

Steel assorted, per tin 3s. 6d.

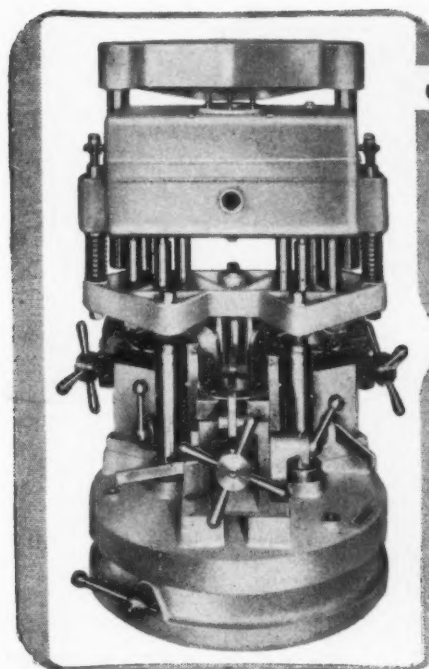
Brass " " 7s. 3d.

8 Macready's Metal Co., Ltd., Pantonsville

Road, N.I. Subject to confirmation by

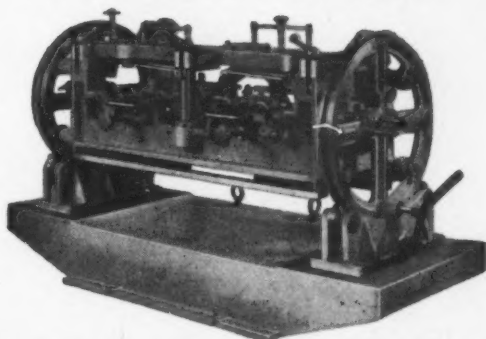
London Office. Delivered free by van in

London area.



## JIGS • FIXTURES

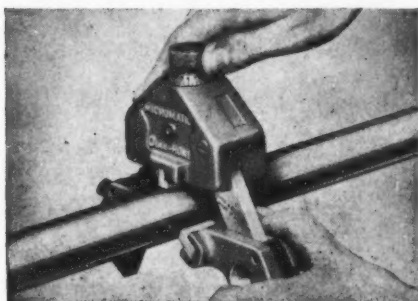
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TELEPHONE VICTORIA 5666

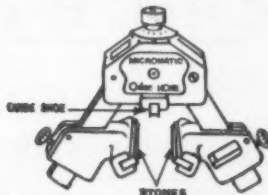


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A general-purpose honing tool requiring  
no special machine or skill to produce  
extremely accurate, highly finished  
surfaces on all types of cylindrical parts.



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Grams: 'Chuck', Leicester

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### **Wolf Cub**

**Special Features of Design and Construction**

This Portable Saw and Groover is of robust but lightweight construction and the unit consists of two aluminium castings which form a secure cradle for the Cub Drill, this being mounted on to a pressed steel soleplate. A special feature is the

kit No. 12

The makers of this famous kit rely on ..  
**ALUMINIUM  
 PRESSURE  
 DIECASTINGS**

by THE

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### EXPERTS IN THE IMPOSSIBLE

Many of the run-of-the-mill jobs that our investment casting foundry turns out by the hundred or thousand started by being labelled 'impossible': complex shapes, bristling with re-entrant angles, in difficult machining metals like stainless, heat resisting, high speed and cobalt alloy steels.

Over the years we have developed our techniques and equipment to the point where we actually welcome the 'impossible'. Our foundrymen are experts, like these men in the photograph. They are relying on the reflex judgment of years of experience to decide when the melt will be ready to pour from the arc furnace.

In addition we can command the facilities of the Napier Metallurgical, Chemical and Mechanical Research Laboratories. This is how we are able to turn out many thousands of precision castings each week for all types of engineering projects, from aero and marine engines, aircraft, guided missiles, automatic machinery and farming machinery, right down to mechanical toys.

Perhaps *you* have a job which is costly to machine and (in your opinion) 'impossible' to cast. If so, we'd like to hear about it. We may be able to help you.

Our 24-page booklet "Napier Investment Castings" can be obtained by writing to Napiercast Foundry, 211 The Vale, W.3.

## NAPIERCAST

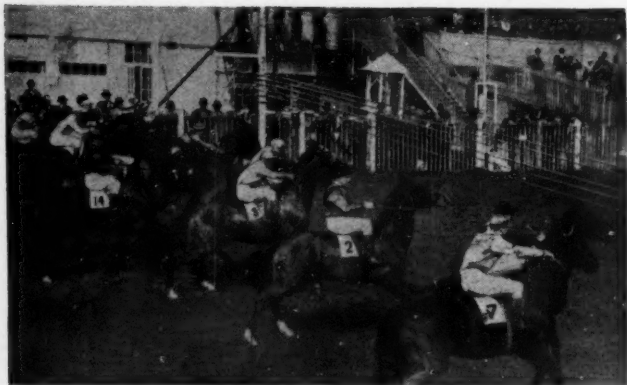
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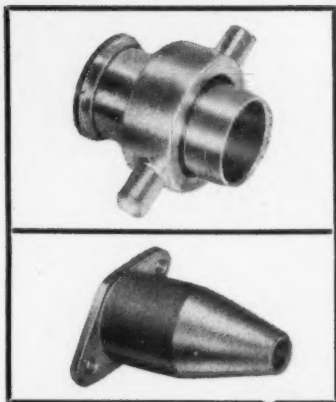
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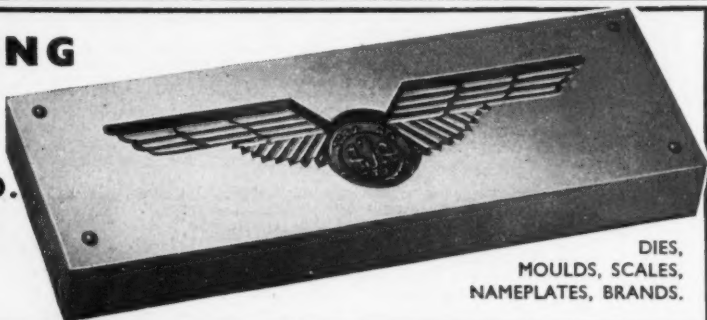
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Max. torque 290 lb.-in. at 1,000 p.s.i.

Max. speed 1,800 r.p.m.

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## Special Hot Die and Mandrel Steel



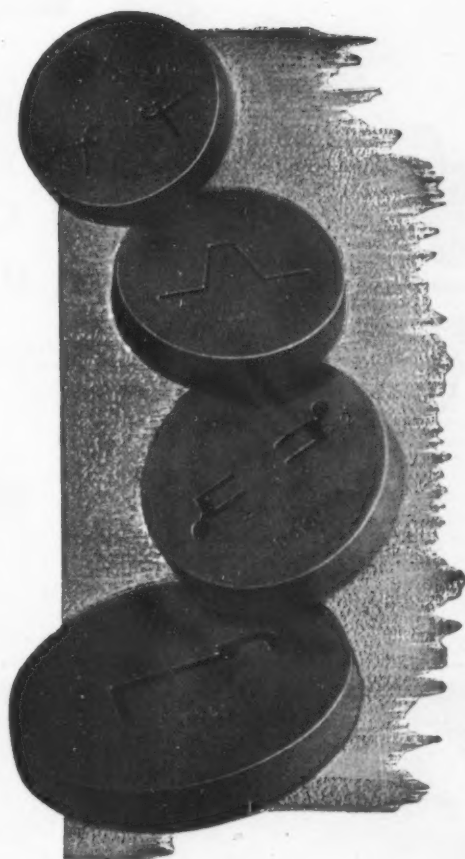
"Motor 12S" is suitable for many Hot Work purposes up to approximately 600/650° C.

Possesses a high degree of red hardness and may be water cooled during work.

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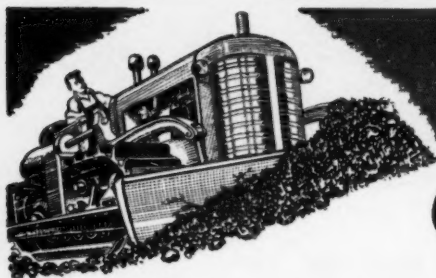
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Patent No. 627324.



CLAMP  
IN OPEN  
POSITION



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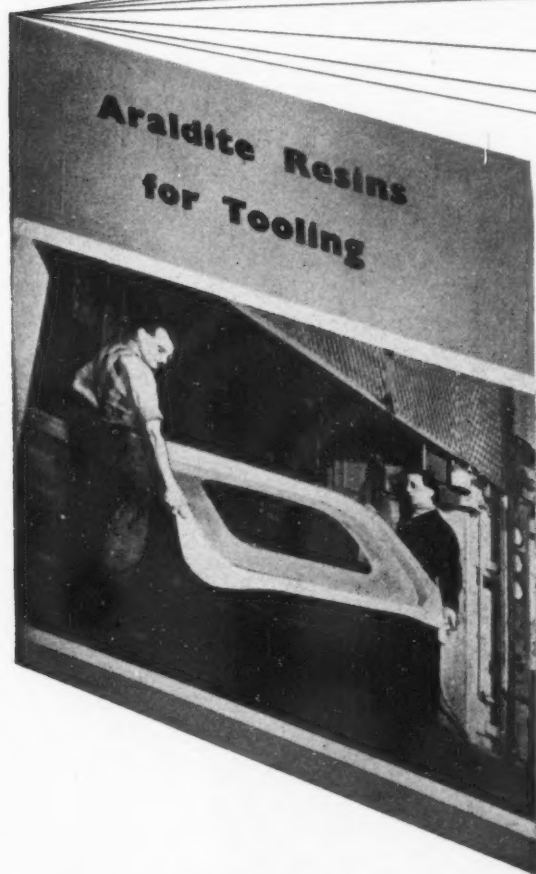
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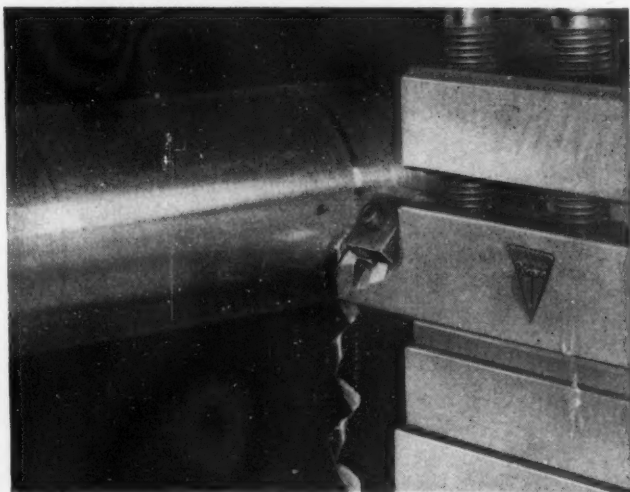
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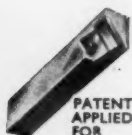
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We shall be pleased to advise you on suggested applications for this tool and the services of our Chief Demonstrator are available to demonstrate the Cross Chord in your own works.



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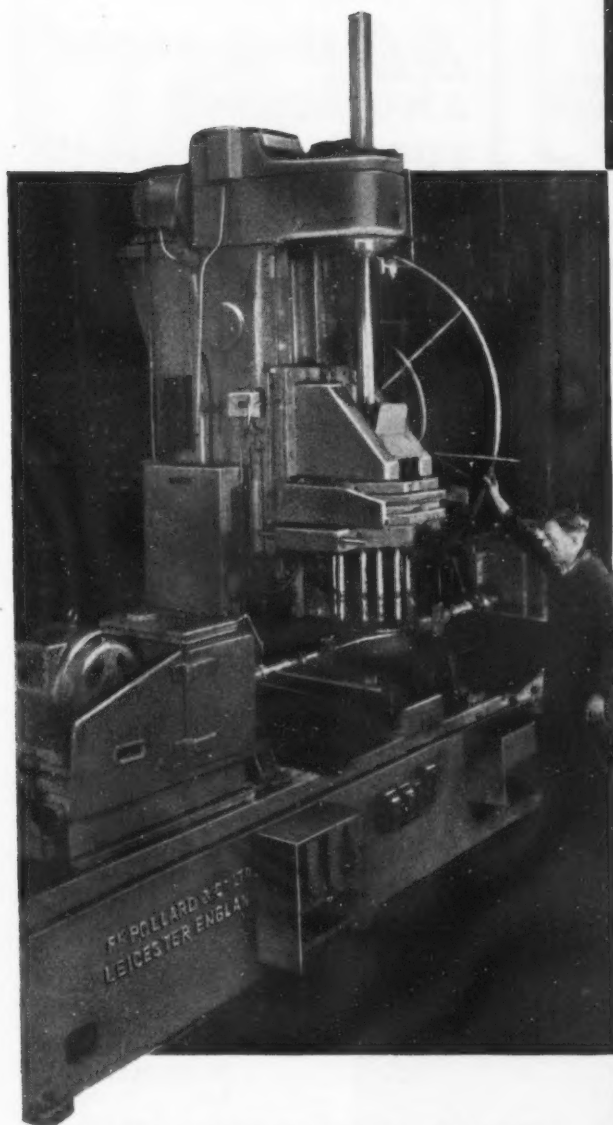
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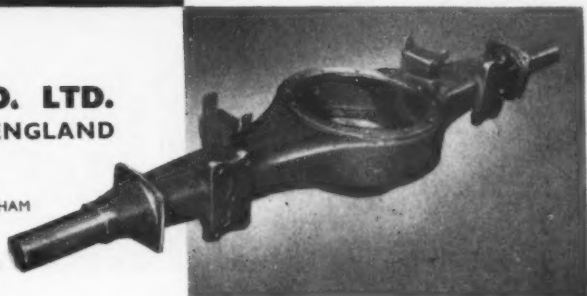
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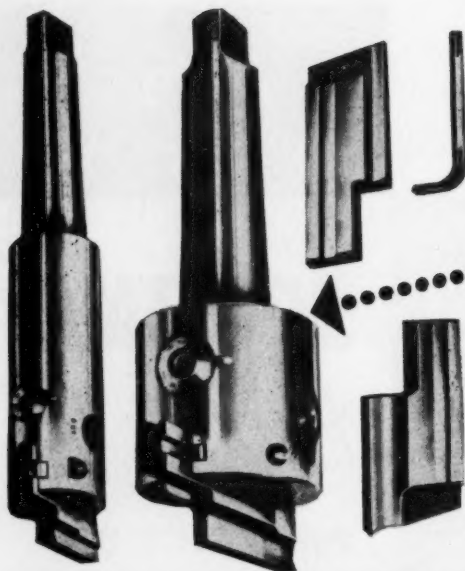
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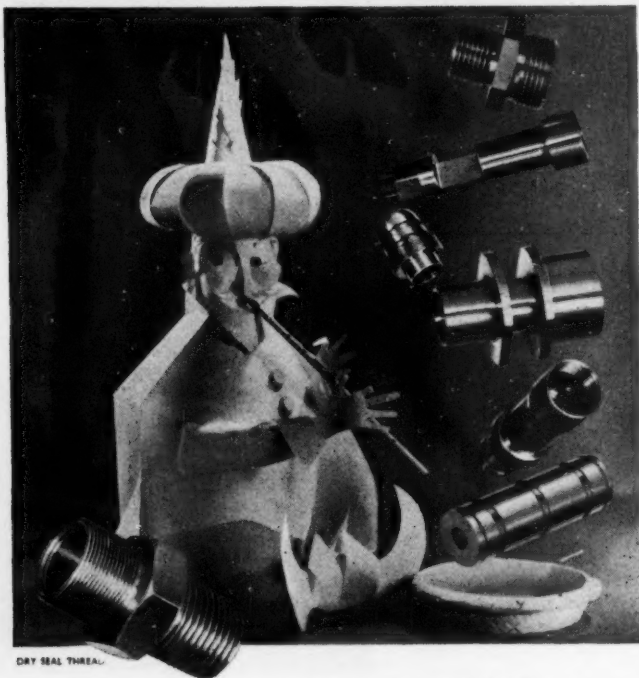
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2½ in. to 3½ in. and 4½ in.

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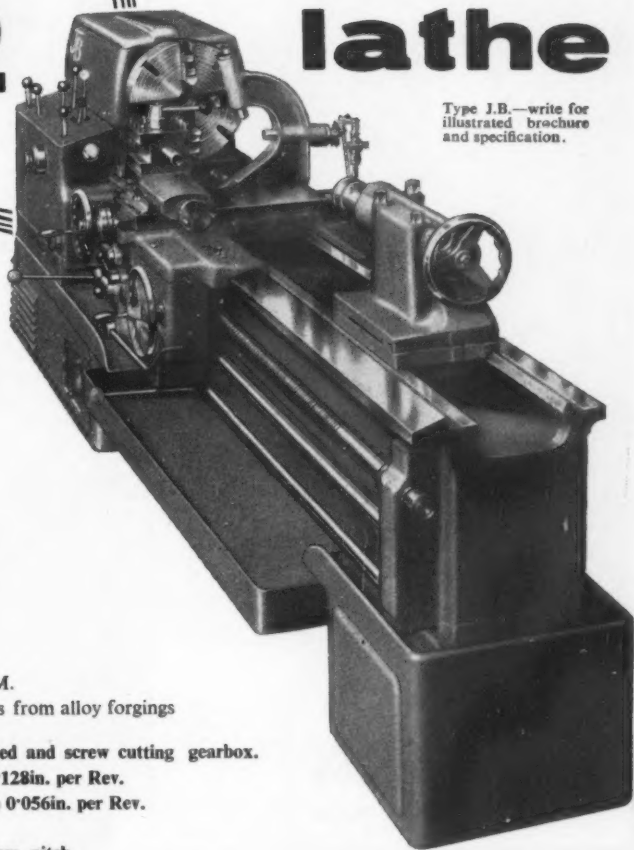
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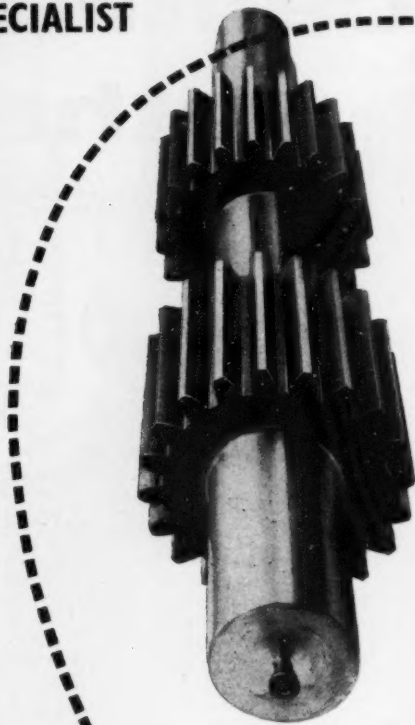
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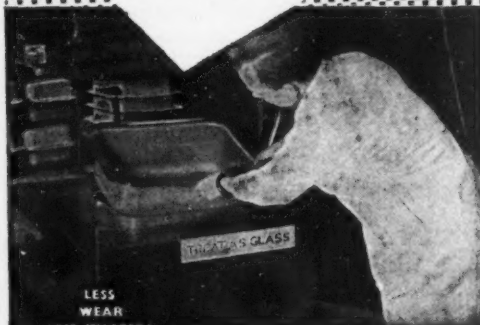
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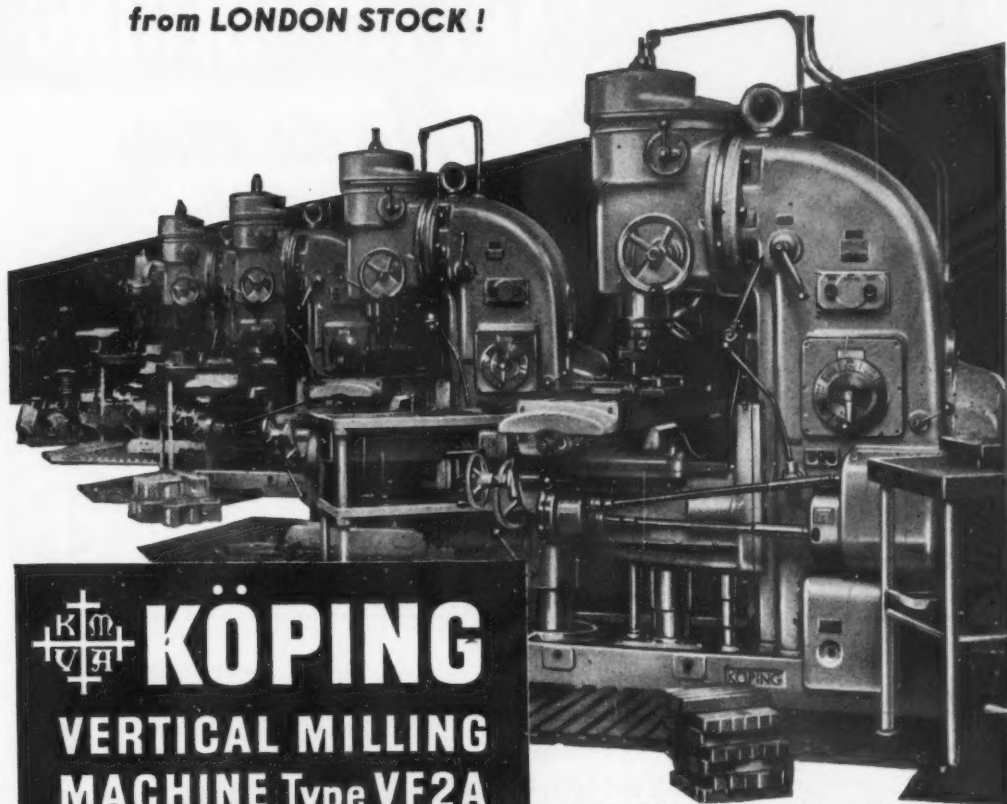
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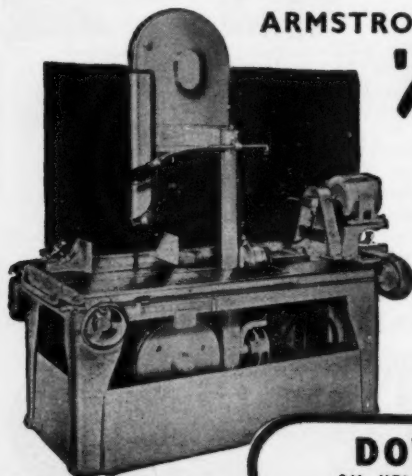
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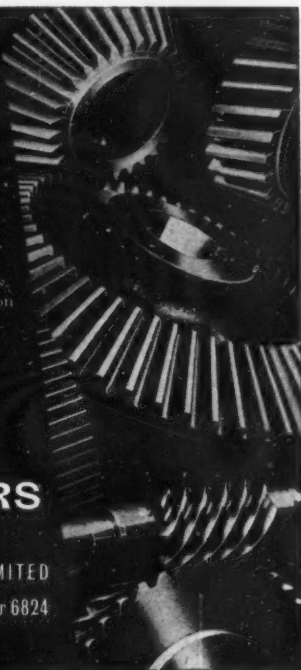
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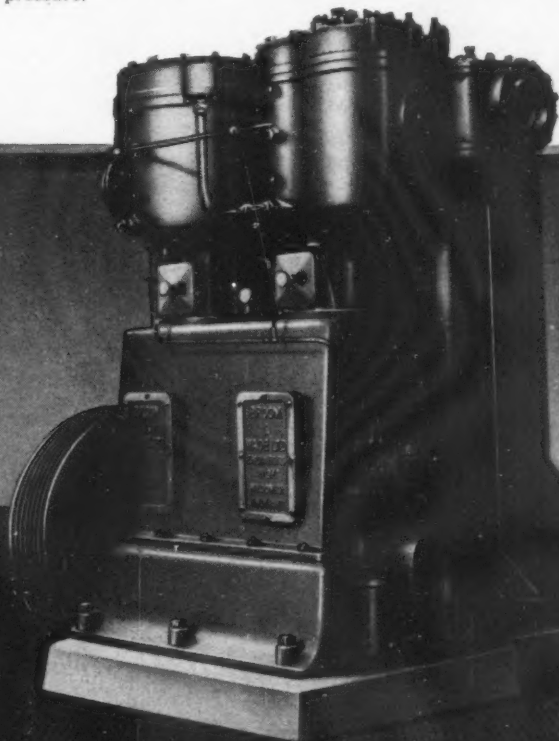
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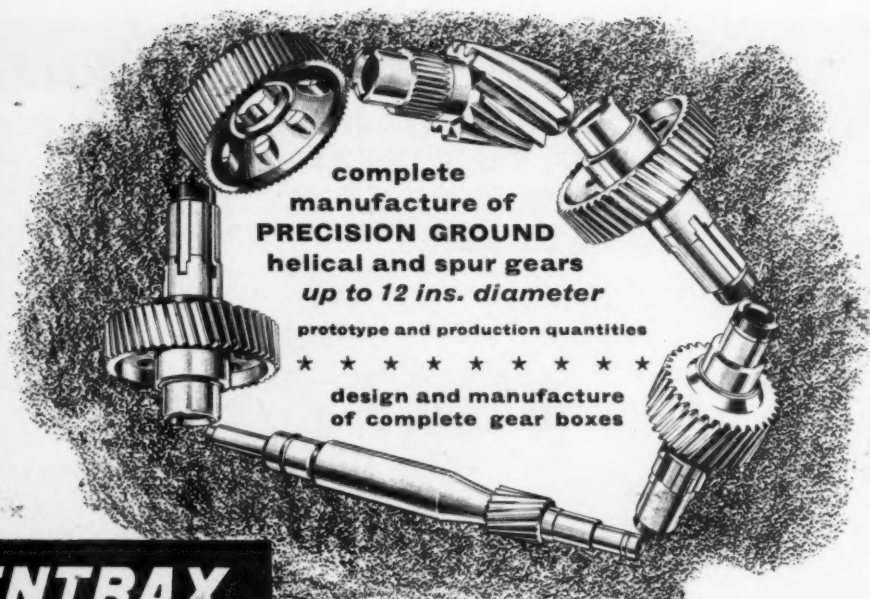
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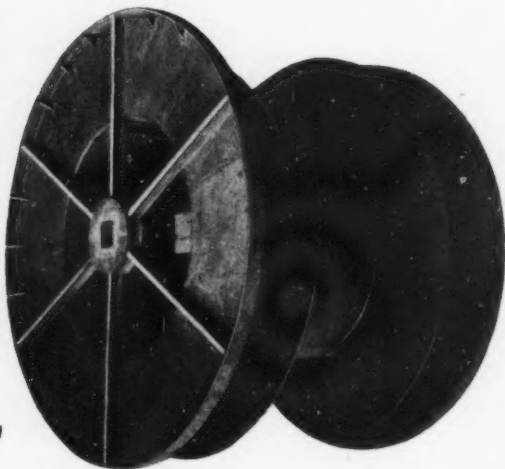
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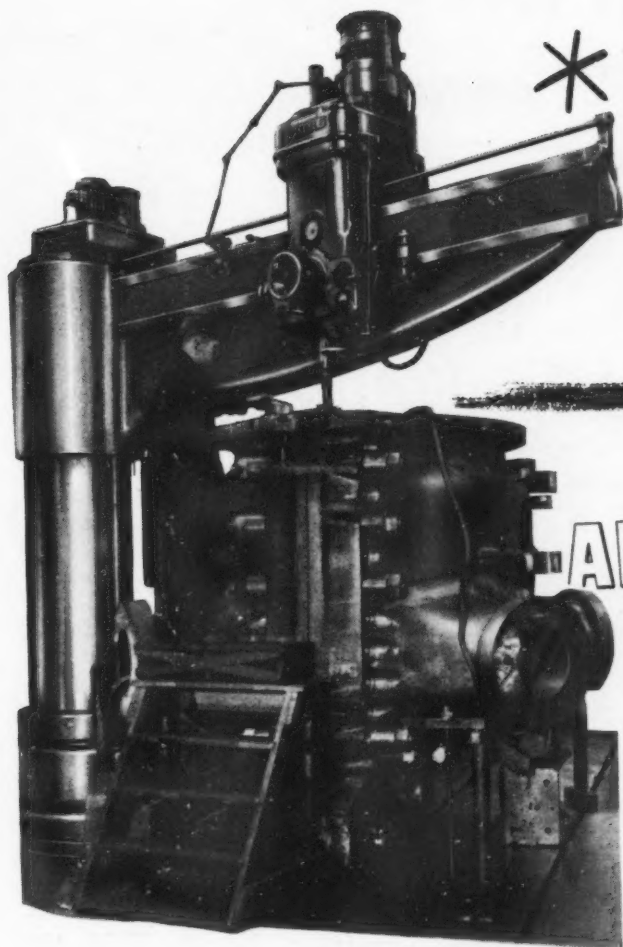
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These machines give 22 spindle speeds and 18 rates of feed, all pre-selected at any time, with the spindle stationary or running.

Capacity: 3½" diameter in mild steel. Speeds: 11-1450 r.p.m. Feeds 8-540 r.p.i. Built in sizes from 5 ft. to 14 ft. spindle radius.

**JAMES ARCHDALE**

**& COMPANY LIMITED**

**LEDSAM ST., BIRMINGHAM, 16**

Telephone No. EDGbaston 2274

A Member of the Staveley Coal & Iron Co. Ltd.  
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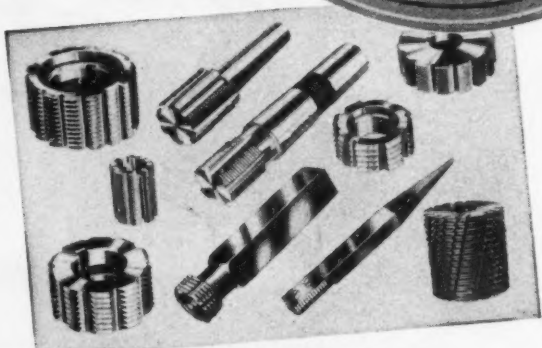
Sole Agents: **ALFRED HERBERT LTD. COVENTRY**  
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We are specialists—and these tools are made in our own Works from tungsten steel of the highest grade, carefully heat treated and inspected. Pitch and form are of guaranteed accuracy. Our Swiss Reishauer grinders have increased our capacity, particularly for 'specials', and we hold a large stock of standard sizes for every make of machine.



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Ask us to send  
our detailed  
catalogue.

121



# *Shim Washers*



MADE IN SIZES UP TO 10in.  
OUTSIDE DIA. IN STEEL OR  
BRASS SHIM STOCK FROM  
0.002in. TO 0.020in. THICK.  
ALSO IRREGULAR SHAPES

We shall be pleased to receive your  
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MANSFIELD

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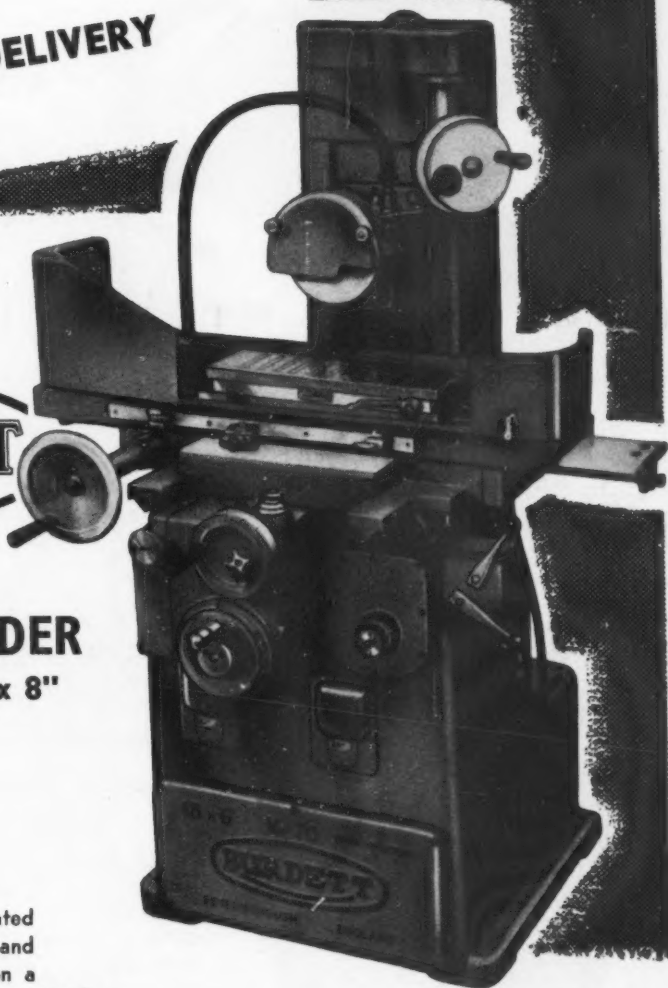
*The*  
**BURDETT**

**HIGH PRECISION  
SURFACE GRINDER**

**18" x 6" and 24" x 8"**

- ✱ **SIMPLE**
- ✱ **PRECISE**
- ✱ **RELIABLE**

A simple, hydraulically-operated machine, reasonable in price and capable of outstanding results on a wide range of work. Table traverse hand or hydraulic. Cross feed hydraulic, giving a movement in either direction of 0.010in. to 0.060in. per stroke. Nitralloy spindle in special lead bronze bearings, ensuring exceptionally accurate grinding to a good surface finish.

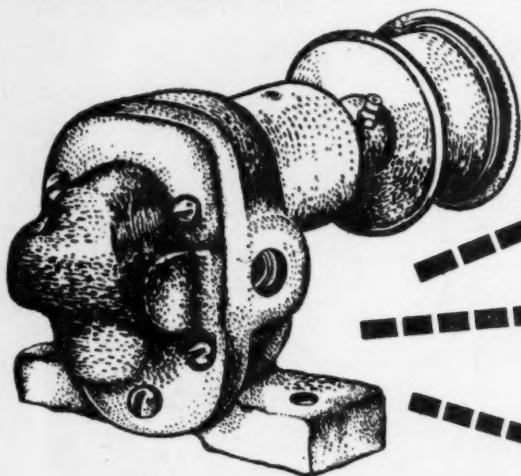


MAIN DIMENSIONS		Model 70	Model 75
TABLE WORKING SURFACE ...		18" x 6"	24" x 8"
LONGITUDINAL TRAVEL ...		19"	25"
MAX. DISTANCE TABLE TO WHEEL ...		9½"	12"
VERTICAL MOVEMENT OF WHEEL ...		10"	12½"
CROSS FEEDS ...		0.010" to 0.060" per stroke	ditto.
TABLE SPEEDS (INFINITE) ...		5-60 ft./min.	ditto.

**G. W. S. BURDETT & CO. LTD. · EASTGATE · PETERBOROUGH · ENGLAND**

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**" WITHOUT A DOUBT "**

This is a long-life pump, self pumping, with hardened steel or ph. bronze gears.

Body in robust cast iron or stainless steel.

Delivery from stock in  $\frac{3}{4}$ ",  $\frac{1}{2}$ ",  $\frac{3}{8}$ " and 1" delivery.

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## OLDAK DIAL GAUGES

**ACCURATE · ROBUST · DEPENDABLE**

**Compare**

THESE PRICES  
 0.0005in. or 0.01mm.  
 from £2.17.3  
 0.0001in. or 0.002mm.  
 from £5.4.6.

THESE FEATURES  
 Stainless steel rack and pinions  
 Rotatable bezel  
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 Continuous and balanced readings on the same scale ring  
 Stainless steel hardened case stem

**GENEROUS TERMS TO MERCHANTS**

AND, of course, BSI accuracy and dimensions  
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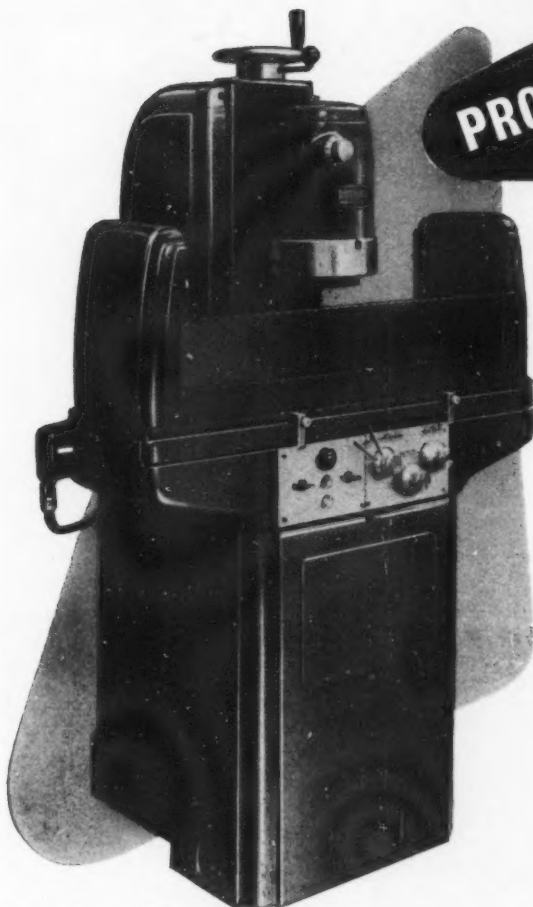
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## Step up Production with the

# PRODUCTION MASTER

MODEL PM2



### HIGH PRECISION HYDRAULICALLY OPERATED VERTICAL SPINDLE SURFACE GRINDING MACHINE

This machine has been specifically designed for production surface grinding operations where a high degree of accuracy and fine micro-inch surface finishes are required.

Under these conditions one P.M.2 is capable of giving an output equivalent of three or even four horizontal spindle surface grinders of the same capacity.

Allow us to carry out grinding tests on your components and submit a full report on the results.

### PROVEN ON THESE RECENT TESTS

➤ A 15 hour job reduced to 2 hours.

➤ A surface finish of one micro inch on 2½ in. dia. tungsten carbide discs.

### SPECIFICATION

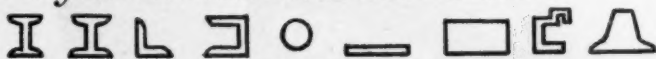
Grinding Capacity ... 20 in. by 6 in. by 10½ in. under wheel  
Table Size ..... 42½ in. by 11 in.  
Longitudinal traverse ..... 25 in.  
Rate of Feed ..... 5 - 25 ft. p.m.  
Weight ..... 13½ cwt. net; 15½ cwt. gross

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UNION ROAD, CROYDON, SURREY, ENGLAND

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**KALTENBACH****UNIVERSAL COLD SAWING MACHINE***Do you cut sections like these?***in Steel, Bronze, Copper and Light Alloys**

Compare these cutting times on the Kaltenbach Saw with existing methods.

Solid bars	1" =	20 sec.
	3" =	2½ min.
Channel	5" x 2" x ½"	1 min.
Iron	6" x 2½" x ¾"	1¼ min.

**Features:**

All angles instantly obtainable without swivelling work.

Automatic feed infinitely variable.

No deflection in saw blade due to vertical feed.

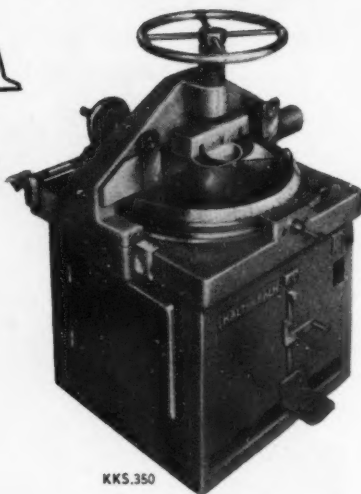
Burr-free cut.

2 speeds.

**Extras available:**

2 extra cutting speeds for light alloys.

Air clamping arrangement as duplex machine.



KKS.350

**F.J. Edwards Ltd**

Sole British Agents

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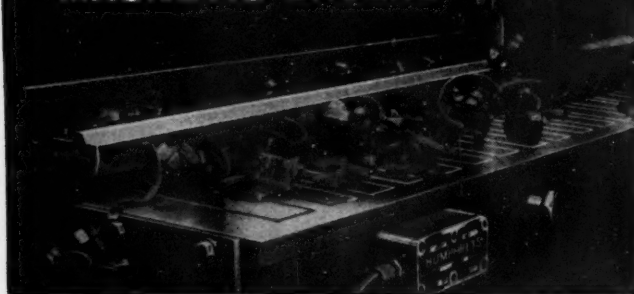
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### MAGNETIC CHUCKS



**for PLANING  
MACHINES**

*get a GRIP  
on production*

**LOADING TIME IS IDLE  
TIME—KEEP THE MACHINE  
CUTTING ALL THE TIME  
WITH A HUMPHREYS CHUCK**

The HUMPHREYS magnetic chuck with suitable stop and supports grips the section of 60 lb. rail without resort to clamps of any kind whilst a reasonably heavy cut ⅝" deep x .040" feed is taken.



**J. H. HUMPHREYS & SONS LTD.**

BLACKRIDING ELECTRICAL WORKS

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MAGNETIC CHUCKS, WORK  
HOLDERS, MAGNETIC EQUIP-  
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*Isn't it time  
you had a look at  
our catalogue and  
price list*



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GROVE RD · HARPENDEN · HERTS  
Telephone: HARPENDEN 3603/4

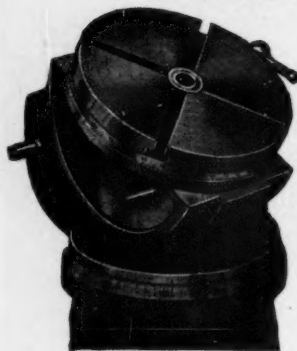
**THE ORIGINATORS & MANUFACTURERS  
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## ACE 10in. Heavy duty Die.

### UNIVERSAL ANGLE TABLE



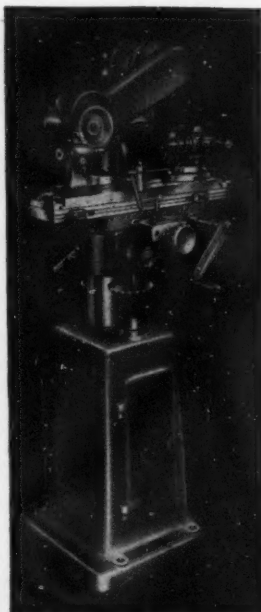
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ROTARY &  
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TABLE  
WITH  
SWIVELLING  
BASE

- ★ FOR  
DRILLING  
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GRINDING
- ★ FOR  
TOOLROOM  
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★ **UNIVERSAL APPLICATION !!!**

**W. URQUHART** 1023-7 Garratt Lane, London  
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## THE AMAZING FRIKLA

STANDARD AND  
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The Most Inexpensive T & C  
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Country

FULLY UNIVERSAL TOOL  
AND CUTTER GRINDER  
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7in. swing x 20in. centre

Compact — Movements in  
every possible direction.  
Grinds all types of cutters,  
reamers, etc. Included in  
standard equipment is a  
special Dividing Headstock.  
Silk-like movements. Built to  
the same fine limits and  
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*Prompt Delivery*

### TRADE SUPPLIED

MOTORIZED WORK HEAD  
EXTRA

ALSO VERTICAL AND  
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● Swivelling Head for Angular and Surface Grinding

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Types*

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'REGALOX' TEST PIECE  
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Let our "REGALOX" technical development advisory service tell you how "REGALOX" can be applied to your products, your production and maintenance.

## HARD CERAMICS FOR ENGINEERING



NEARLY DIAMOND HARD

**WEAR & HEAT RESISTANT • DIMENSIONALLY STABLE UNDER ALL CONDITIONS • LOW CO-EFFICIENT OF FRICTION • HIGH PHYSICAL PROPERTIES**

With a hardness between diamond and sapphire, highly resistant to wear and possessing excellent physical properties, "REGALOX" hard ceramics now open up new possibilities in the fields of Chemical, Electrical and Mechanical Engineering.

Unaffected by high working-temperature, "REGALOX" remains dimensionally stable under all conditions. It holds close dimensional tolerances and concentricity. It is impervious to moisture and withstands the action of practically all chemicals. Where required, components can be high temperature metallised—a process which has already had a wide application in the Electronics field.

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"REGALOX" is already operating successfully in the Textile, Wire, Paint, Brickmaking, Grinding, Copper, Tin, Mechanical, Chemical, Nucleonic, and General Engineering Industries. Typical applications include:—Drill Bush Liners—Plug Gauges—Jig Bases—Textile and Wire Guides—Sand Blast Nozzles—Pump Seals and General Machine Components—Fuse Cores—Tiles—Grinding Balls—Brickmould Liners—Insulators—Bushes—Rods and Tubes.

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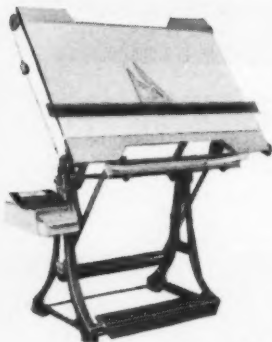
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## DRAFTING MACHINES & DRAWING TABLES

ISIS Drafting Machines are now fitted with improved Protractor heads, the special features are fully explained in our ISIS catalogue, which will be gladly sent on request. The ISIS Drawing Tables are in complete balance at any height or inclination of the board.



Isis drawing table fitted with Isis drafting machine



Isis drawing table fitted with parallel motion straight edge.

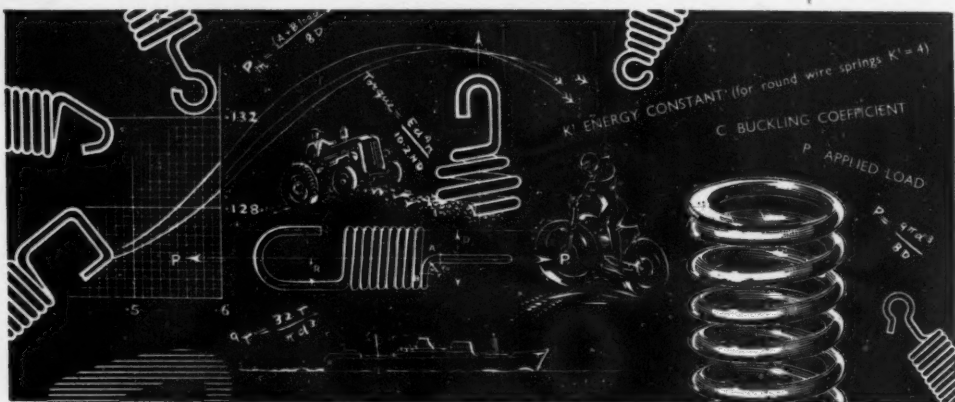
We are distributors of **RIEFLER** Drawing Instruments of quality

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CRAWFORD SPRING WORKS • NORMAN ROAD • ROCHDALE

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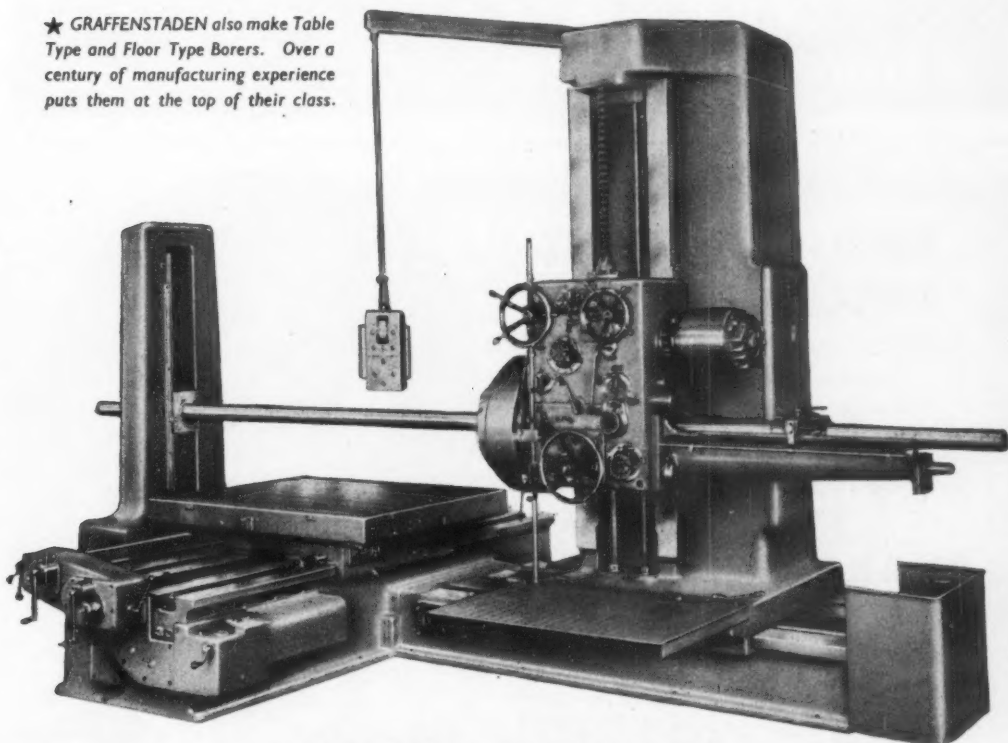
**BORERS**  
ACCURACY

**CROSS BED**  
FOR GREATER

Moving Column can be brought close to the job · Table fully supported in all positions

ALL GRAFFENSTADEN BORERS HAVE : 1. Hardened and ground gears. 2. Rapid traverse to all movements including rotation of table. 3. Spindle of high tensile nitrided steel. 4. Faceplate rotating independently of the spindle, so that both can operate simultaneously at the same or different speeds. 5. Outer support bearing moving up and down automatically, simultaneously with the spindle.

★ GRAFFENSTADEN also make Table Type and Floor Type Borers. Over a century of manufacturing experience puts them at the top of their class.



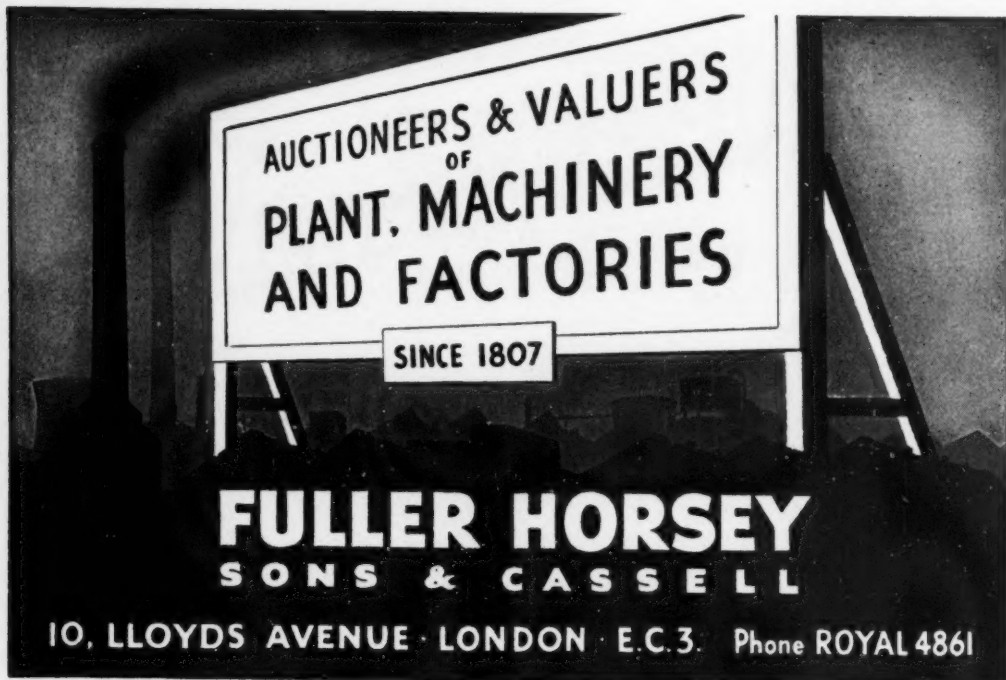
Sole Distributors for  
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SONS & CASSELL**

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DRILLS SHARP...**

RAPIDLY AND CHEAPLY ON THE

**"Reliance"**  
BRITISH MADE

**TWIST DRILL  
SHARPENING MACHINE**

- ★ SIMPLE — FOOLPROOF
- ★ NO BUSHES NEEDED
- ★ ANGLE ADJUSTMENT FROM 60° TO 180°
- ★ BACKING OFF ADJUSTABLE AS REQUIRED

**Two Sizes**

$\frac{1}{8}$  in. to  $\frac{1}{2}$  in. Capacity  
 $\frac{1}{4}$  in. to 2 in. Capacity

WRITE NOW FOR COMPLETE DETAILS—

**H. D. MURRAY LTD.,**

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No. 1 Ribbed Smoked Sheets from Selangor River Estate—or Harewood Estate—these names mean Rolls-Royce quality to the man who buys rubber. We buy these rubbers to make the best V-Belts you can buy.

Then we process it on equipment made by names such as Bridge, Iddon, and Shaw, and on many ingenious machines made by our own engineers.

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**J • H • FENNER & CO • LTD • HULL**  
**LARGEST MAKERS OF V-BELT DRIVES IN THE COMMONWEALTH**

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**CROID 65**  
MACHINE FIXING GLUE  
**COOPERS**  
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## HOW CAN THEY EXPECT GOOD WORK WITH THIS NOISE & VIBRATION?

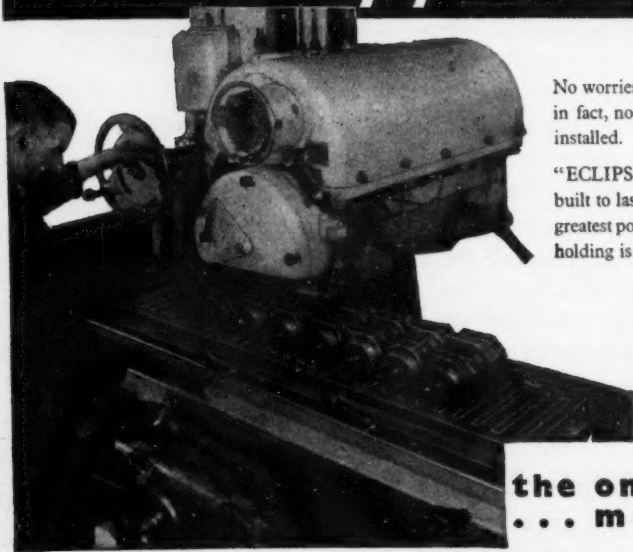
Vibration doesn't only wear out workers. It wears out machines too. Luckily, there's Croid-Cooper nowadays. With the Croid-Cooper method, you stick your machines down like a stamp—but a stamp with a holding power of 50 lbs. to the square inch—move them when you like, do away with bolting, grouting,



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No worries about maintenance or power failure — in fact, no trouble at all from the day they are installed.

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**the only name for ...  
... magnetic tools**

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Supplies through appointed "Eclipse" Distributors

FM 131

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## STANDARD AIR CYLINDERS

**REDUCED  
PRICES**

**STOCK  
DELIVERIES**



### STANDARD FEATURES

- Light alloy end covers and manganese bronze bearing housing.
- Steel-backed lead-bronze bearing bush.
- Precision ground steel piston rod.
- Fully adjustable cushioning.
- Wide choice of mountings.
- Specially finished seamless steel tubing.

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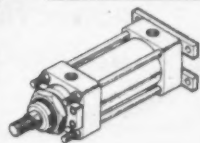
- Non-ferrous cylinder barrels available up to 4in. bore
- Piston rod wiper seals.

RANGE FROM 2in. to 8in. DIAMETERS  
STOCK STROKES 3in., 6in., 9in. and 12in.  
ANY OTHER STROKES AVAILABLE

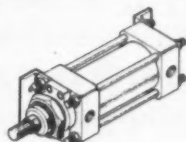
## MARTONAIR LIMITED

PARKSHOT · RICHMOND · SURREY · ENGLAND

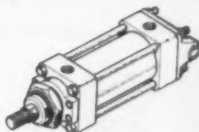
TELEPHONE : RICHMOND 2201 (6 lines)



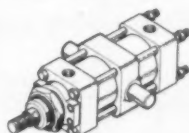
FLANGE MOUNTING  
B



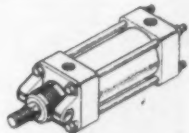
SIDE MOUNTING  
C



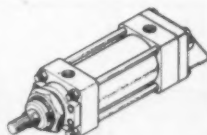
REAR  
TRUNNION MOUNTING  
D



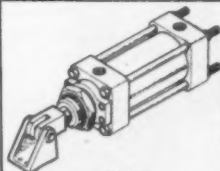
CENTRAL  
TRUNNION MOUNTING  
H



FRONT  
TRUNNION MOUNTING  
K



REAR  
HINGE MOUNTING  
L

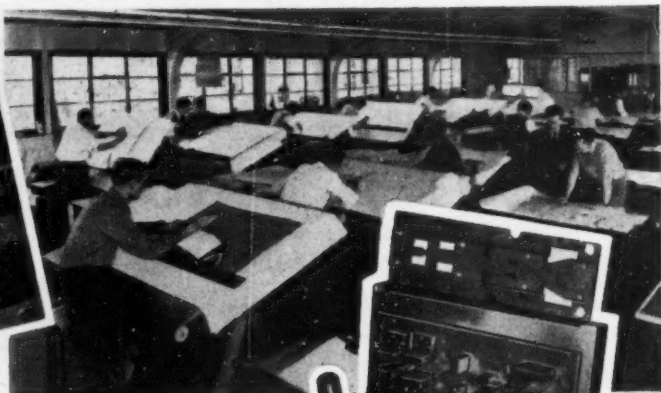
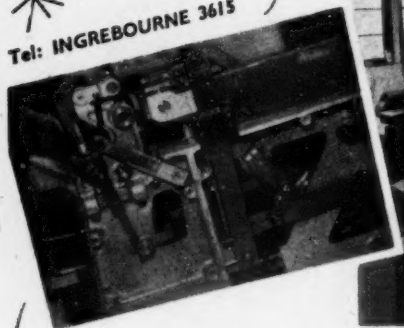


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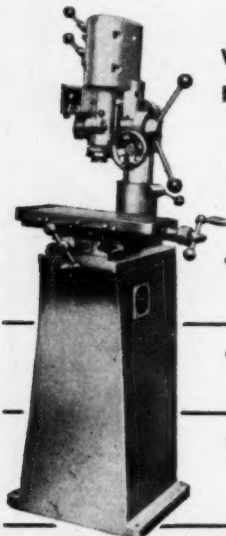


**PRODUCTION TOOLS & MACHINERY  
DESIGNED & MANUFACTURED**



**L. A. DREW & Co. Ltd. BRYANT AVENUE • ROMFORD**

**ESSEX**



## ARBOGA

**VERTICAL MILLING MACHINE  
MODEL EM 825**

**Fills an out-  
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for small work.**

- Table, 17½in. by 9½in. or 22in. by 9½in.
- Longitudinal traverse, 11in. or 15½in.
- Eight speeds, 100 to 2,900 r.p.m.
- Table to Spindle 20in.
- Swivelling head, Rigid Column, Cast-iron base, No. 3 Morse Taper, 1in. bore.
- Price: £265, 17½in. table, £277 10s., 22in. table.

DISTRIBUTORS AND STOCKISTS FOR THE UNITED KINGDOM.



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**DECREASE SCRAP  
PRESSINGS PRODUCTION  
BY USING...**



**The universal drawing device  
for any size and make of press**

**WORSON DIE CUSHIONS LTD.**  
RABONE LANE WORKS • SMETHWICK • STAFFS.

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**TYPE 11 P**

The standard rotary shaft seal. Gives perfect sealing at high speeds and for long periods, with minimum frictional loss.

**TYPE 11 P/B**

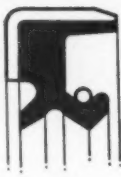
As type 11 P but with the casing covered with rubber. Interchangeable with metal case seals.

**TYPE 23 P**

An external seal used when fitting conditions prevent the use of 11 P or 11 P/B seals.

**TYPE 12 P**

A rotary shaft seal used to separate two different fluids.

**TYPE 13 P**

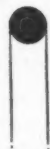
Similar to type 12 P but without a spring on the second lip which serves as a dust excluder.

**TYPE 31 P**

A springless seal used as a wiper or dust excluder for rotating or reciprocating shafts.

**NU-LIP RINGS**

A special section ring which cannot twist. Superior to the O-ring for low and medium pressure non-static applications.

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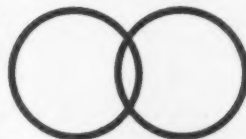
A compact automatic seal for reciprocating and static applications over a wide range of temperatures and pressures. All British Standard sizes in stock.

**TYPE 7 P**

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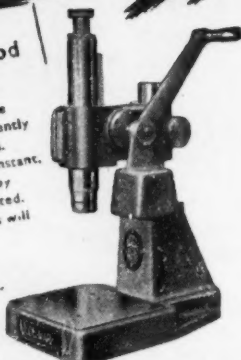
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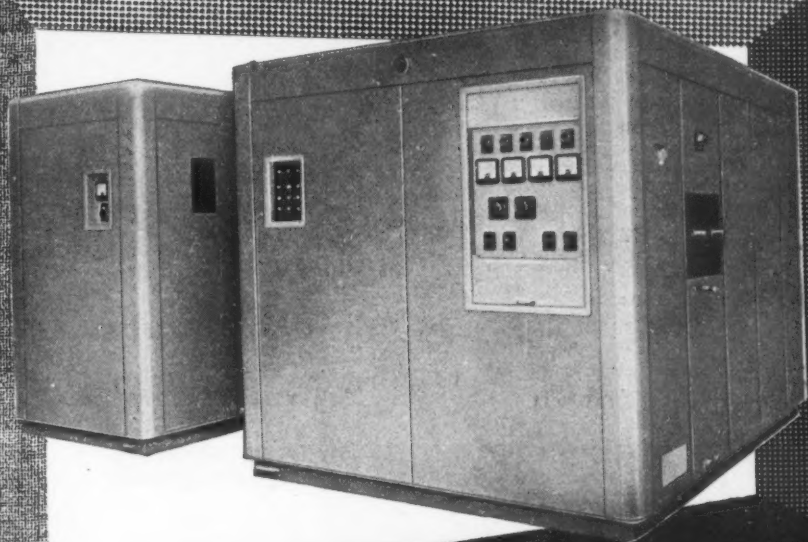
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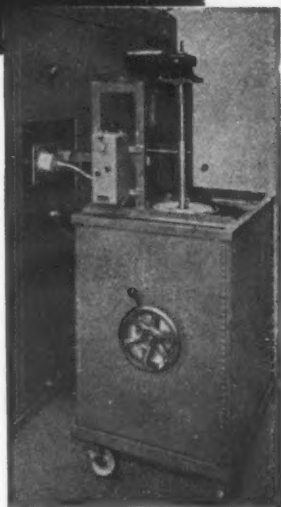
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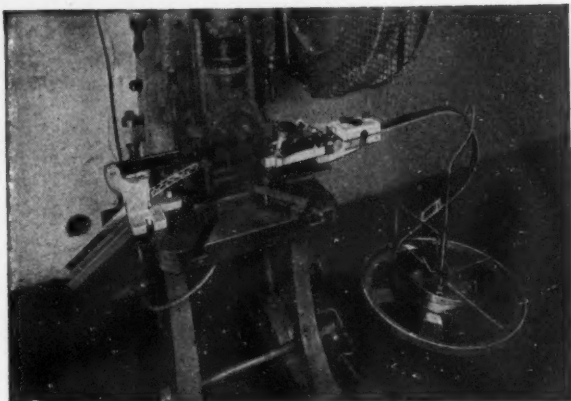
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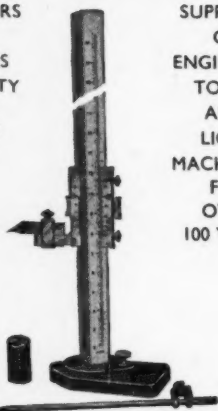
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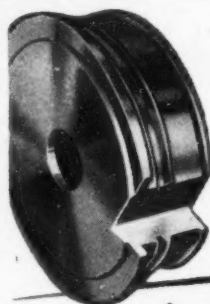
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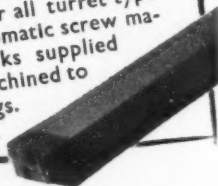


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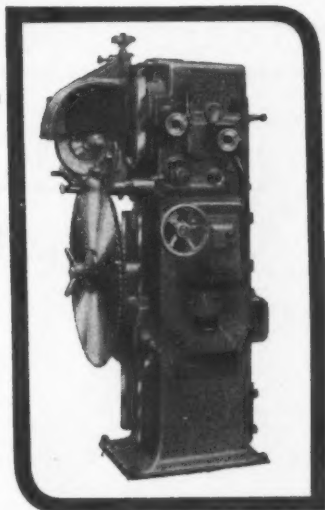
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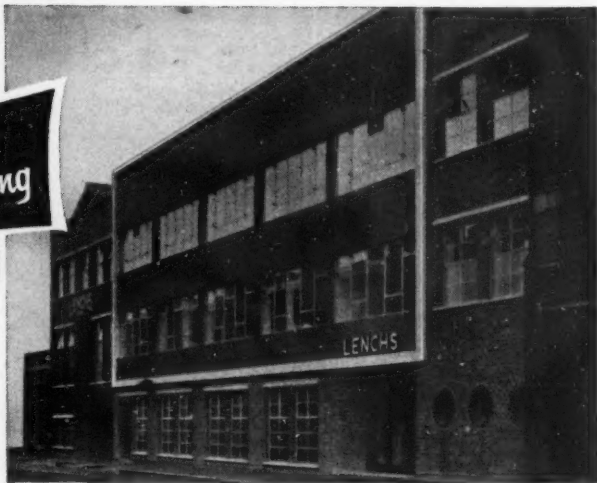
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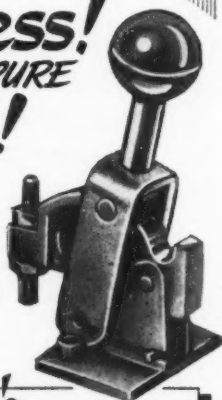
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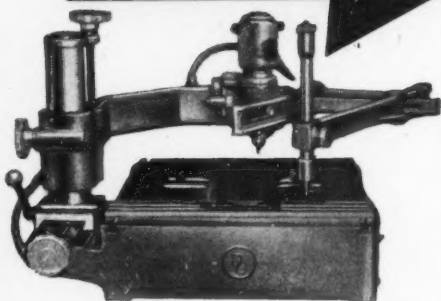
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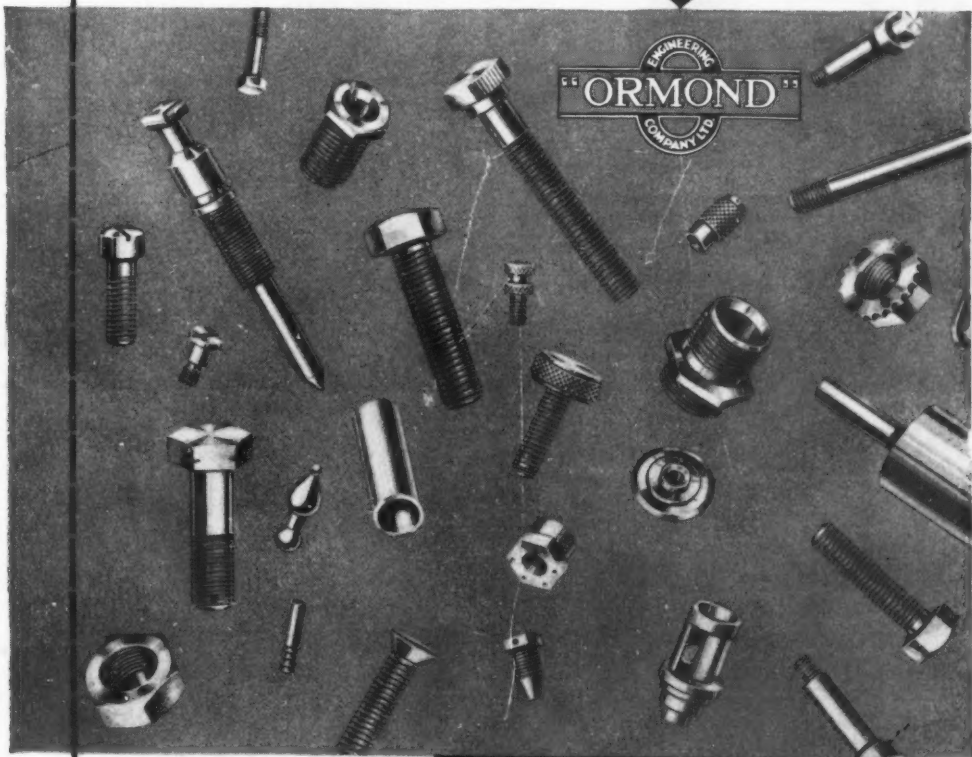
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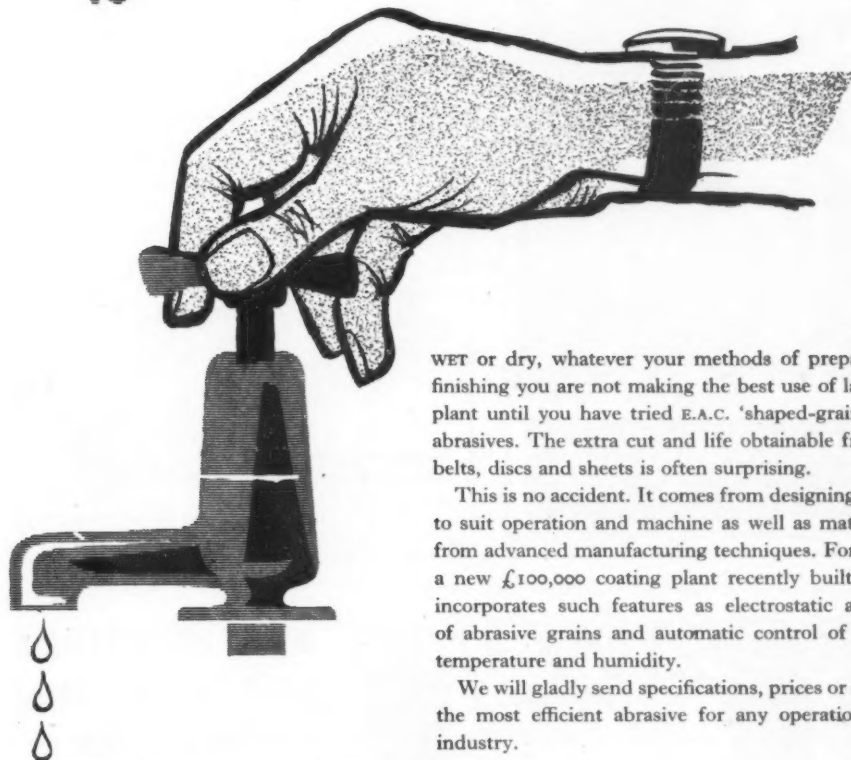
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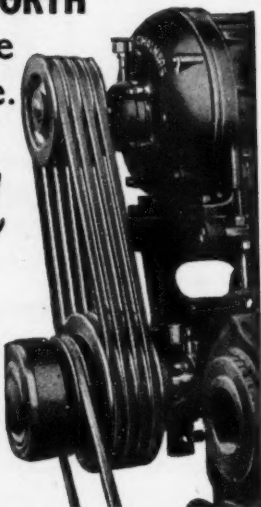
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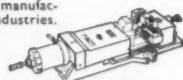
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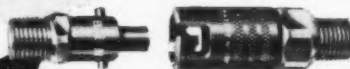
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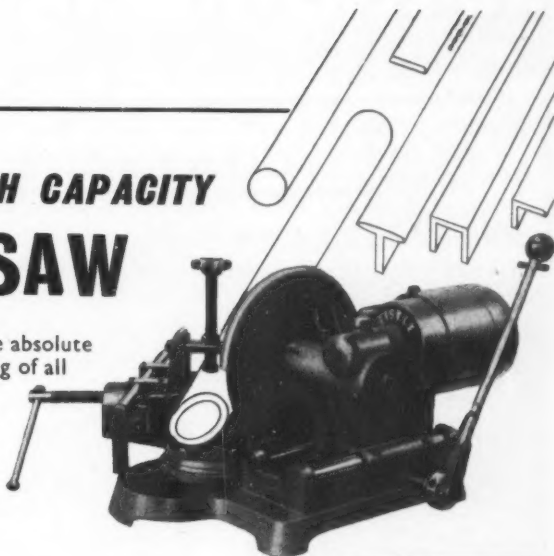
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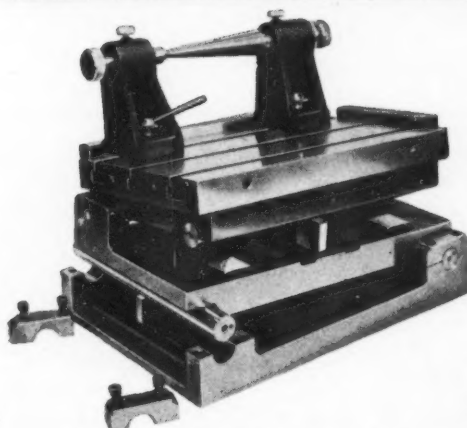
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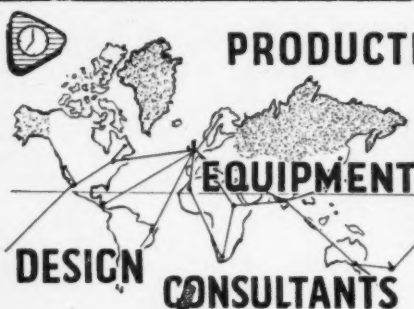
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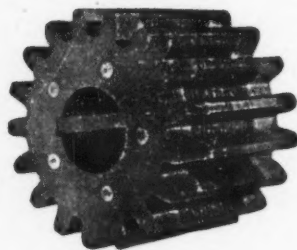
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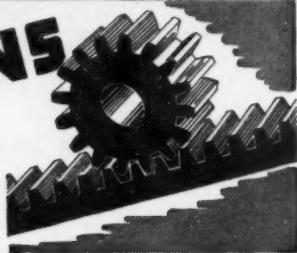
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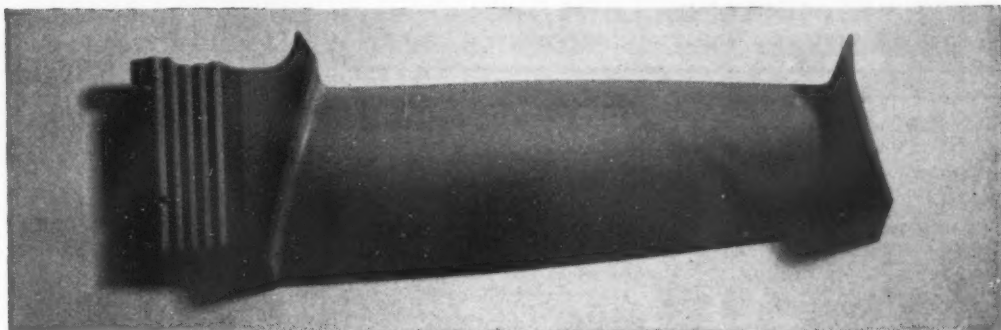
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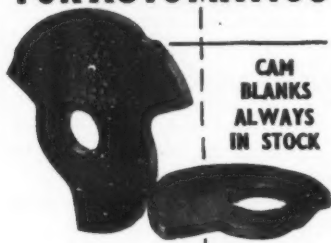
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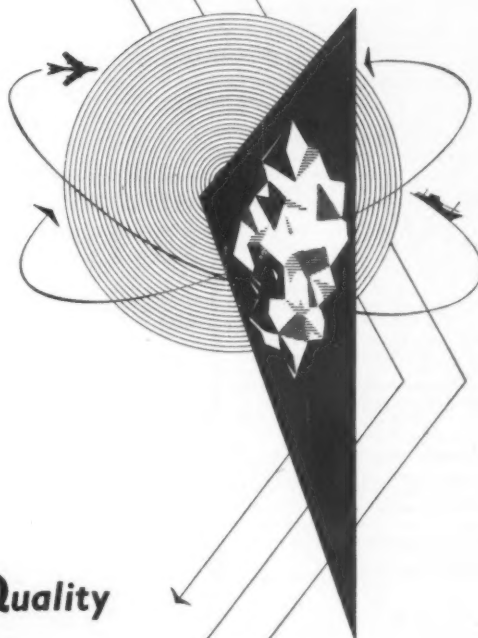


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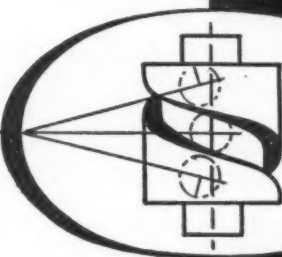
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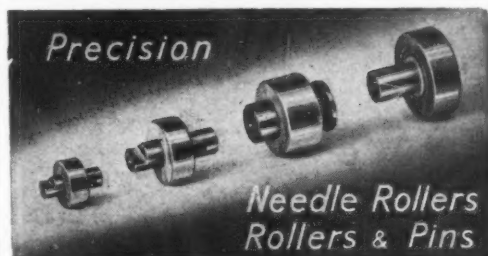
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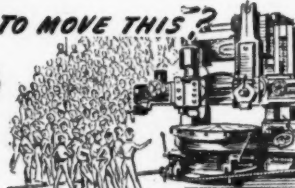
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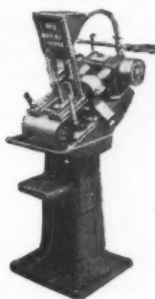
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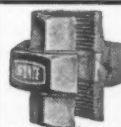
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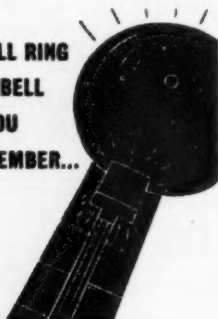
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range 11-490 r.p.m.

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S.S. & S.C. Gap Bed Lathe.** Speed  
range 11-490 r.p.m.

**DENHAM 6 $\frac{1}{2}$ in. by 3ft. 6in. S.S. & S.C.  
Gap Bed Lathe.** Speed range 10-400  
r.p.m.

**KITCHEN & WADE 4ft. No. 5 M.T.  
Radial Drill.** Speed range 20-1,000 r.p.m.

**TOWN 4ft. No. 3 M.T. Radial Drill.** Speed  
range 20-1,000 r.p.m.

**TOWN 3ft. No. 2 M.T. Radial Drill.** Speed  
range 126-1,450 r.p.m.

**ARQUITH Type E.G.C. 6ft. Girder Type  
Radial Drill.** Speed range 183-560 r.p.m.

**ARQUITH Type E.G.C. 8ft. Girder Type  
Radial Drill.** Speed range 31-830 r.p.m.

**HEALD 47B Borematic.**

**KEARNS Type OA Horizontal Boring  
Machine.**

**B.S.A. 6in. Automatic Screwing Machine.**

**KENCO 6-3 Screwing Machine.** Com-  
prehensive equipment.

**CLIFTON & BAIRD Punching and Cropping  
Machine.** Capacity 4 $\frac{1}{2}$ in. by 4in. by  $\frac{1}{2}$ in.  
angle.

**BIGWOOD 4-Roll Bending and Straighten-  
ing Machine.** Capacity 4ft. by  $\frac{1}{2}$ in.

Modern Machines—Motorised 400-440/3/50.  
Fully Overhauled—Six Months Guarantee.

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(SWANSEA) LTD.

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**Newman****FOR MACHINE TOOLS**

Below are selected offers from our extensive and varied stock

**SLOTING MACHINES****MUIR** 17in. Stroke Vertical Slotting Machine.**GRINDING MACHINES****SCRIVENER** No. 2 Centreless Grinding Machine.**LANDIS** Plain Hydraulic Cylindrical Grinding Machine, capacity, 10in. by 96in.**LANDIS** Hydraulic Universal Grinding Machine, 14in. by 36in. between centres.**LANDIS** Type D Hydraulic Crank Pin Grinding Machine, capacity 21in. by 72in.**NEW EXCEL** No. 3 Hydraulic Surface Grinding Machine.**BROWN & SHARPE** No. 2 Surface Grinding Machine, capacity 6 in. by 18in.**NORTON** Universal Grinding Machine, type "C", capacity 12in. by 36in.**LANDIS** Type "C" Plain Hydraulic Cylindrical Grinding Machine, capacity 10in. by 36in.**CHURCHILL** Universal Grinding Machine, 10in. by 24in. between centres.**NORTON** 6in. by 18in. Plain Cylindrical Grinding Machine.**B.S.A.-LANDIS** Type "C" Plain Hydraulic Cylindrical Grinding Machines, 6in. by 30in. (Two available.)**CHURCHILL** Model HBY Internal Grinding Machine.**EXCEL** No. 3 Horizontal Spindle Hydraulic Surface Grinding Machine 24in. by 8in. with magnetic chuck.**ABWOOD** Vertical Spindle Surface Grinding Machine 6in. by 18in.**BORING MACHINES****UNION** Horizontal Boring Machine, Model BFT, 100 3/4in. dia. travelling spindle, 24in. dia. facing head (1957).**RICHARDS** Type PRT Horizontal Type Floor Boring Machine, 3 1/2in. dia. travelling spindle and 28in. dia. facing head.**ASQUITH** 7in. Horizontal Floor Boring Machine.**BERTHIEZ** Model 9340 Vertical Boring Mill table diameter 7ft. 10in., maximum turning capacity 9ft. 6in. (1953.)**JUNGENTHAL** Model KE.1200 Vertical Boring Mill, table diameter 39in., maximum turning capacity 50in. (1954.)**FRORIEP** Vertical Boring Mill, table diameter 39in., maximum turning capacity 52in. (1955.)**KEARNS** No. 3 Horizontal Boring Machine, 3 1/2in. diameter travelling spindle, maximum facing diameter 24in.**RICHARDS** Double Column 6ft. Vertical Boring Mill, maximum turning capacity 72in.**MILLING MACHINES****CINCINNATI** Hydromatic 3/24 Duplex Production Milling Machine, (2 available)**MILWAUKEE** No. 241 Vertical Milling Machine, table 50in. by 10in.**REED PRENTICE** No. 6 Vertical Milling Machine, table 84in. by 20in.**SUNDSTRAND** Hydro-Screw Rigidmill Automatic Production Milling Machine, table 7in. by 14in., table traverse 48in.**CINCINNATI** 1/12 Horizontal Production Milling Machine.**CENDEC** Model 3R Automatic Production Milling Machine, table 8in. by 30in.**CINCINNATI** 2M Universal Milling Machine.**MILWAUKEE** No. 4H Plain Horizontal Milling Machine, table 74in. by 15 1/2in.**VICTOMATIC** Automatic Cycle Production Milling Machine, capacity 50in. by 10in.**REED-PRENTICE** No. 5 Vertical Milling Machine, table 68in. by 16in.**GEAR MACHINES****MUIR** 72in. spur and helical Gear Generating Machine.**ORCUTT** 24in. Gear Grinding Machine.**KOLB** Gear Grinding Machines.**SYKES** V.10 Gear Generator.**GLEASON** 3in. Bevel Gear Generators. (Two available.)**GLEASON** No. 9 Bevel Gear Completer Machine.**DRILLING MACHINES****KITCHEN & WADE** 28V10 Single Spindle Vertical Drilling Machine, No. 4 M.T.**ARCHDALE** Multi-spindle Drill Machine, 36 spindles.**HETTNER** Radial Drilling Machine, having 10ft. Radial Arm elevating column type.**TOWN** 30in. Vertical Spindle Boring, Drilling and Tapping Machine, No. 5 M.T.**KITCHEN & WADE** 4ft. 6in. Radial Drilling Machine.**KITCHEN & WADE** 4ft. Radial Drilling Machine.**ASQUITH** ODI 6ft. Radial Drilling Machine.**CAPSTAN & CENTRE LATHES****WARD** 7B Hexagon Turret Lathes with bar feed. (Two available.)**OLDFIELD & SCHOFIELD** Boring and Surfacing Lathe, cross-traversing Turret type.**LE BLOND** Regal Centre Lathe, 9 1/2in. by 42in. between centres.**BRADFORD** 8 1/2in. centre height by 30in. between centres Centre Lathe.**HERBERT** No. 8 Combination Turret Lathe.**URQUHART LINDSAY & ROBERTSON** ORCHAR Centre Lathe, 16in. by 30ft. 6in. between centres.**LIBBY** Model 2H-8 Combination Turret Lathe, 8 1/2in. hollow spindle.**HERBERT** No. 12 Combination Turret Lathe with comprehensive tooling.**NILES** Centre Lathes 13 1/2in. centre height by 27ft. between centres. (Two available.)**NILES** Centre Lathes, 15in. centre height by 28ft. between centres. (Two available.)**BETTS-BRIDGEFORD** Centre Lathe, 15in. centre height by 16ft. between centres. (Two available.)**WARD** No. 7 Combination Turret Lathe.**AUTOMATICS****ACME GRIDLEY** Model RA6 2 1/2in. spindle Bar Automatic.**PONGRACZ** Single Spindle Automatic capacity 10 mm.**CONOMATICS** 3 1/2in. 4-spindle Bar Automatics. (Three available.)**BULLARD** 8in. 6-spindle Vertical Chucking Automatic.**BULLARD** 11in. 8-spindle Vertical Chucking Automatic.**PLANING MACHINE****URQUHART LINDSAY & ROBERTSON** ORCHAR Spiral Drive Heavy Duty Planing Machine, capacity 16ft. by 5ft. by 5ft.**MISCELLANEOUS****SHEEPBRIDGE** 20/22in. Hydraulic Cold Circular Sawing Machine.**Newman**  
for  
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One (1) New RASKIN 45.IB 45 tons capacity Open Back Ungearbed Inclined Press. Adjustable Stroke 4in. to 5in. Bed area 28in. by 18 1/2in. Max. daylight 16 1/2in.

One (1) New RASKIN R.7 120-ton capacity Open Front Rigid Geared Power Press with Adjustable Stroke 4in. to 4 1/2in. Bed area 35 1/2in. by 24 1/2in. Depth of throat 12 1/2in.

One (1) Used H.M.E. Type L.70 Open Back Geared Inclined Power Press, adjustable stroke 1in. to 4in. Capacity 70 tons. Bed area 32in. by 26 1/2in. Depth of throat 10 1/2in. Gap through back 12 1/2in.

One (1) Used BRADLEY & CRAVEN 41/44 Straight Side Double Crank Geared Power Press, capacity 80 tons. Bed area 44in. by 42in. Stroke 2 1/2in. Daylight to top of bolster ram down adjustment up 7 1/2in. Bolster 3 1/2in. thick. One (1) New RUSHWORTH 8ft. by 4in. M.S. Overcrank Geared Drive Guillotine Shearing Machine with cam operated Plate Hold down, 4in. gap in end frames.

One (1) New PEARSON 10ft. by 4in. M.S. Electro Hydraulic Guillotine Shearing Machine with 12in. gap in end frames.

One (1) Unused RUSHWORTH 150/8 All Steel Frame Press Brake, forming capacity 8ft. by 4in. M.S. Distance between columns 97in. Overall bed 114in. Die space ram down 12in. Gap in end frames 10in.

One (1) New PROST Type No. 375, 73in. by 4in. Power Operated Swing Beam Angle Bending and Folding Machine with 7in. lift to top beam.

One (1) New BARNES 8ft. by 4in. Open Throated Upstroking Hydraulic Bending Press, length of stroke 12in., depth of gap in end frames 6in.

One (1) New ELDAIR Model '01' Alligator type Shears with all steel welded construction, length of blade 30 1/2in., shear 12in. by 4in. flats, 1 1/2in. rounds. Blade opening 10 1/2in.

One (1) New STECO SBM.2 Section Bending Rolls of the horizontal shaft type, capacity 2in. by 2in. by 4in. angles, beams on flange 4in. by 1 1/2in. by 5 lbs., flats on edge 2in. by 4in., squares 1 1/2in.

All arranged for Motor Drive 400-440/3/50

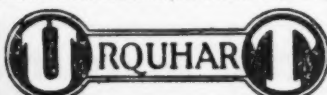
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## NEW MACHINES EX STOCK FOR IMMEDIATE DELIVERY

COLCHESTER Lathes, Mascot, 8in. by 60in.

TRIUMPH 7 1/2in. by 48in.

STUDENT 6in. by 24in.

CHIEFMASTER 5in. by 24in.

"ACE" Bench Lathe, 4 1/2in. centres by 23in. between. Norton feed box and on cabinet stand. 415/3/50.

ROBLING Lathe, Model 600/2, 5 1/2in. centres by 24in. between, 1,920 r.p.m., accuracy 0.0002in. 415/3/50 A.C.

PFEIFER Precision Toolroom Lathe. Model P.12, 9in. centres by 44in. between, 1,000 r.p.m. Norton feed box, 187 threads Whitworth, metric and module, turning accuracy 0.002mm. 415/3/50 A.C.

TROGLIA Lathe. Model TPM20, 10 1/2in. centres by 76in. between, 31in. in gap, 850 r.p.m., Norton feed box. Whitworth, metric and module. 415/3/50 A.C.

GRANVILLE SENIOR 3 1/2in./4in. H.D. Bench Centre Lathe, 21in. b.c. Motorised.

ASTRA 6in. Stroke Slotting Machine, 4 speeds to ram, compound table. Mot. 415/3/50.

SENIOR M.1 Horizontal Milling Machines. Table 25in. by 6 1/2in. W/S, longt. power feed, spindle speeds 12, 50/1,650 r.p.m., coolant pump. Motorised 415/3/50.

P.T.V. Universal Mill. Model 51. Table 33 1/2in. by 8 1/2in., power feed, 60/1,300. Dividing heads, etc. 415/3/50.

P.T.V. Vertical Mill. Model IV. Table 39in. by 8 1/2in., power feed all directions, swivel head, rise and fall, speeds 60/1,400, dial change. 415/3/50.

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FIVE STAR Tool and Cutter Grinder, capacity 5in. by 12 1/2in., with motorised workhead for external and internal grinding. 415/3/50.

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Milling M/c. Speeds to 615 r.p.m. M/d 400/3/50. Complete with Vertical Head.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. 'Phone: TERMINUS 0167/8/9.

**Snow P24 Hydraulic Horizontal**

Surface Grinding Machine, capacity 24in. by 8in., motorised 400/3/50. Two machines available.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton, Tel.: Southampton 73101.

## 18in. CENTRE SS & SC GAP BED LATHE by GRANOR

35ft. between Centres.

20 h.p. Electric with IGRANIC ELECTRIC Company, Dynamic Plugging Relay Switch.

Quick Power Traverse to Saddle.

All Controls Duplicated on Saddle.

18 Spindle Speeds 6 to 300 r.p.m.

One 3-pin Roller Steady, 1 1/2in. to 10in. Capacity.

One 3-pin Roller Steady, 6in. to 15in. Capacity.

Complete Coolant Equipment.

THIS MACHINE IS IN FIRST CLASS

CONDITION.

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**NEW MITCHELL 16in. CENTRE x 24FT.**

**GAP BED LATHE**

Admit between centres ... 17ft. 3in.  
Swing over saddle ... 25in. dia.  
Swing in gap ... 61in. dia. x 18 1/2in.  
Hollow spindle dia. ... 4 1/2in.

**NEW MITCHELL 14in. CENTRE x 16FT.**

**GAP BED LATHE**

Admit between centres ... 9ft. 9in.  
Swing over saddle ... 21 1/2in. dia.  
Swing in gap ... 52in. dia. x 17in.  
Hollow spindle dia. ... 4 1/2in.

**TWO NEWALL TYPE LA 10in. x 48in.**

**HEAVY DUTY HYDRAULIC PLAIN**

**GRINDING MACHINES**

With oscillating type wheelhead.

Admits between centres ... 48in.  
Grinding diameter ... 10in.  
Wheel diameter admitted ... 36in.  
Wheel face admitted ... 10in.  
Maximum swivel of table ... 8 deg.  
Number of wheel speeds ... 4  
Range of wheel speeds ... 677-1,150 r.p.m.  
Quick run back (wheelhead) ... 3in. or 4in.  
Oscillation of spindle ... 0-1in.

**UNUSED HEYLINGSTAEDT 47in. SWING**

**MOTOR DRIVEN SURFACING AND**

**BORING LATHE**

Motor 18 h.p., 4-way toolpost; power feed to top slide; stepless spindle speeds.

Height of centres ... 23 1/2in.  
Maximum swing over bed ... 47in. dia.  
Spindle speed range (stepless) ... 41 to 225 r.p.m.  
Longitudinal feeds (9) ... 0.2 to 2.0mm.  
Cross feeds (9) ... 0.13 to 1.3mm.  
Maximum longitudinal saddle traverse ... 29 1/2in.  
Morse taper in spindle ... No. 6

**ARCHDALE 30in. FIG. NO. 14583 ALL**

**GEARED MOTORISED DIAL TYPE**

**VERTICAL MILLING MACHINES**

Working surface of table ... 44in. x 14 1/2in.  
Auto. longitudinal traverse ... 30in.  
Auto. cross traverse ... 12in.  
Hand vertical traverse ... 18in.  
Hand vertical feed of spindle slide ... 5 1/2in.  
Maximum distance, spindle to table ... 20in.  
Distance spindle to column ... 16in.  
Spindle bored ... 3 1/2in. per ft.  
Spindle speeds (12) ... 20-520 r.p.m.  
H.P. of motor ... 5

**KEARNS HORIZONTAL SURFACING, BORING**

**MILLING, DRILLING, TAPPING AND**

**SCREW CUTTING MACHINE**

Diameter of spindle ... 3 1/2in.  
Maximum diameter machine will face ... 42in.  
Number of speeds to spindle ... 24  
Range of spindle speeds ... 2.5-220 r.p.m.  
Vertical traverse of sliding head ... 24in.  
Size of main table ... 60in. x 36in.  
Size of detachable turntable ... 42in. x 42in.  
Maximum distance between facing slide and boring stay ... 6ft. 9in.

**SNOW MODEL P.24 HYDRAULIC HORIZONTAL SPINDLE SURFACE GRINDING**

**MACHINE**

Grinding capacity ... 24in. x 8in.  
Height admitted under 10in. wheel ... 8 1/2in.  
Longitudinal traverse of table ... 28in.  
Cross traverse of table ... 9in.  
Table speed, infinitely variable ... 0-100ft. per min.  
Cross feed, variable ... Up to 0.1in.  
H.P. of wheel motor ... 3  
H.P. of hydraulic motor ... 2

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**BROWN & SHARPE** OOG Bar Automatic, Vertical Slide, Bar Strand, turret, tools, collets. Serial No. 12715.

### BORES

**RICHARDS** 48in. Double Upright Vertical Boring and Turning Mill, two swivelling toolboxes on cross slide.

### CAPSTAN & TURRET LATHES

**HERBERT** 48S Bar Capstan Lathe, fitted turret toolholders, pump, bar feed, speeds 30 to 511 r.p.m.

**WARD** No. 7 Bar Capstan Lathe, bar feed, speeds 20 to 416 r.p.m.

**HERBERT** No. 20 Combination Turret Lathe, 7½in. diameter spindle, 28in. swing over bed, 97in. distance spindle to turret. Speeds 5 to 201 r.p.m.

### CENTRE LATHES

**LE BLOND** Heavy Duty 33in. swing by 28ft. between centres, S.S. & S.C. Lathe, late type, all geared headstock, twin saddles, taper turning, 32in. diameter, four-jaw chuck, 25 h.p. A.C., 3-phase electric, speeds 4 to 255 r.p.m.

**BROADBENT** 14in. S.S. & S.C. Gap Bed Lathe, admits 90in. swings in gap 50in., speeds 5.5 to 204 r.p.m. Well equipped Nearly New.

**BINNS & BERRY** 12½in. S.S. & S.C. Gap Bed Lathe, admits 7ft. 6in. between centres, speeds 12 to 600 r.p.m. NEW.

**COLCHESTER MASCOT** 8½in. by 54in. All-gear Head Centre Lathe, speeds 37 to 600 r.p.m. NEW.

**COLCHESTER TRIUMPH** 7½in. by 48in. All-gear Head Gap Bed Lathe, speeds 40 to 800 r.p.m. NEW.

**WILLSON** Mark V 7½in. by 48in., S.S. & S.C. Gap Bed Lathe, admits 48in., speeds 54 to 954 r.p.m. and 37 to 739 r.p.m. NEW.

**DEAN SMITH & GRACE** Type "A" 7in. by 31in. S.S. & S.C. Gap Bed Centre Lathe, speeds 11 to 490 r.p.m. Serial No. 21303.

**REIDEN** 7½in. by 40in. S.S. & S.C. Gap Bed Toolroom Lathe, fitted taper turning attachment, pump, 3-jaw chuck, speeds 25 to 1,350 r.p.m. NEW.

**MITCHELL** 6½in. by 64in. S.S. & S.C. Gap Bed Centre Lathe, taper turning attachment, speeds 27 to 400 r.p.m. Nearly New.  
**MYFORD** Super Seven Lathe, 3½in. by 19in., speeds 25 to 2,150 r.p.m. NEW.

### DRILLING MACHINES

**RICHMOND** S.R.2 36in. Radial Drill, elevating table, suds pump. NEW.

**JONES & SHIPMAN** 30in. Model 921, 2-spindle Manufacturing Drilling Machine. 1½in. capacity, speeds 39 to 825 r.p.m. Table 42in. by 24in.

**PROGRESS** 3A Pillar Drilling Machine, Circular table. NEW.

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Machine Tool  
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**NORTON** 10in. by 36in. Hydraulic Horizontal Spindle Surface Grinder, fitted "Humphries" chuck. Toolroom condition.

**BURDETT** Hydraulic Horizontal Spindle Surface Grinder, capacity 18in. by 6in. by 10in. NEW.

**LANDIS** Hydraulic Universal Grinder, type "C", capacity 10in. by 24in. Serial No. 27916.

**MYFORD** M.G.12 Plain Cylindrical Grinder, capacity 5in. by 12in. NEW.

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**CINCINNATI** No. 4 Dial Type Vertical Milling Machine, table 78½in. by 16½in. rapid and power traverses 42in. by 16in. by 16in. Speeds 18 to 1,300 r.p.m. British built 1941.

**BIERNATSKI** No. 5 Swivel Head Vertical Milling Machine, table 78in. by 19in., traverses 49in. by 15in. by 35in.

**CRAVEN** Swivel Head Vertical Milling Machine, table 47in. by 13in., traverses 42in. by 7in. by 12in., speeds 41 to 1,188 r.p.m.

### Universal

**REIDEN** H.F.30 Universal Milling Machine table 59in. by 14½in., rapid and power traverses 39½in. by 11½in. by 15½in., speeds 44 to 1,457 r.p.m. NEW.

**VICTORIA** U.2 Universal Milling Machine, table 45in. by 11in., power feeds 29½in. by 65in. by 16in., speeds 30 to 1,010 r.p.m. NEW.

**RICHMOND** No. 3 Universal Milling Machine, table 48in. by 11in., rapid and power traverses 30in. by 8in. by 16in., speeds 20 to 1,000 r.p.m. NEW.

**DENBIGH** C.4 Universal Milling Machine, table 46in. by 10in., automatic longitudinal feed 36½in., speeds 13 to 400 r.p.m. NEW.

### Horizontal

**ARCHDALE** 20in. Plain Horizontal Milling Machines, table 40in. by 10in., traverses 20in. by 5½in. by 12in., speeds 30 to 615 r.p.m.

**CINCINNATI** 1/12 Automatic Milling Machine, table 35in. by 10in., speeds 50 to 1,500 r.p.m. British built.

All machines motorised 400-440 volts, 3 phase, 50 cycles, A.C. supply.  
Sole London and South of England agents for **BRONX** Press brakes.

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A selection from our 1,500 available tools

**CRAVEN** 18in. double ended Tube Boring and Facing Machine. NEW CONDITION. Maximum length of hole bored 30ft., max. dia. bored 7in., max. dia. of work accommodated 18in., ideal machine for boring and facing forged high pressure vessels.

**ROWLAND** Model ADD 30in. Horizontal Duplex Surface Grinding Machine, discs open 13in., latest type. NEW.

**CHURCHILL** No. 1 Internal Cylinder Grinders, 10in. by 20in. planetary throw 1½in., max. centre spindle to table 12½in., min. 4½in., table 38in. by 12½in., traverse speeds hydraulically variable up to 12ft. per min. NEW.

**MATRIK** Model 16G Internal Thread Grinder, capacity for threads from ½in. to 2in. diameter.

**BROWN & SHARPE** Universal Grinders, No. 2, 12in. by 30in. capacity, complete internal grinding attachment and steadies.

**HERBERT** No. 36 Heavy Duty Duplex Miller, working surface of table 57in. by 14in., longl. auto feed 36in., max. distance between spindles 22½in.

**'COLONIAL'** Broach Grinder for circular broaches, capacity 6in. by 7in.

**HERBERT** No. 5 Automatic Chucking Lathe, swing 16in. over cross slides, 18in. over bed, stroke of turret 13in. equipment includes combination toolholders, overhead pilot bar and air-operated chucks.

**DANIELS** 50-ton Upstroking Hydraulic Plastic Moulding Press, ram dia. 8in., max. stroke of ram 14in., working surface of platens 14in. by 14in., daylight 5in., distance between tables 27in., self-contained pump unit.

**SUNDSTRAND** Rigid 20in. Vertical Rotary Milling Machine, 18in. dia. table, 44 spindle speeds from pick-off gears, 7 to 769 r.p.m., distance centre of spindle to column 18in.

**CHURCHILL-REDMAN** Model 'J' 28in. swing Boring and Facing Lathe, with screwcutting, max. spindle to hexagon turret 9ft.

**CRAVEN** Horizontal Face Miller, working surface of table 11ft. by 2ft. 8in., max. longl. traverse of table 11ft. 6in., 10 rates of feed 1in. to 6in. per minute. 12 speeds 5 to 50 r.p.m. or 10 to 100 r.p.m. H.P. of spindle motor 20, of table motor 15, max. centre of spindle to table 15in.

**PRAEHOMA** Horizontal Spindle Surface Grinders, table 24in. by 8in., with hydraulic feeds. NEW.

**CHURCHILL** Model BY Hydraulic Cam Grinder capacity 10in. by 36in., max. swing over cam table 4in., table speeds hydraulic up to 180 inches per minute.

**GISHOLT** (Foster) Super Finisher, 4in. by 18in. capacity.

**MALICK & WALKOWS** Plain Horizontal Mills, table 47½in. by 12in., longl. feed 26in., cross adjustment 9in., vert. adjustment 15in. NEW.

**ACME-GRIDLEY** RPA-6 12in. swing Chucking Automatic, max. length of turning 8in., range of spindle speeds 23 to 202 r.p.m., travel of toolslide 8in., cross slide 2in. to 4in.

**GOSS & DeLEEuw** 5-spindle 8in. capacity Work Rotating Chucking Automatics.

**POTTER & JOHNSON** 5D Chucking Auto swing 25in. over bed, over cross slide 12in., 20 spindle speeds 16 to 304 r.p.m.

**TAYLOR & CHALLENGE** Type 4J D.P. Double Action Toggle Drawing Press, largest blank admissible 18in. dia., largest article 12in. dia. by 3½in. deep, deepest article 8½in. dia. by 7½in. deep.

**ARCHDALE** 18in. vertical Miller, table 33in. by 13½in., fitted with sliding and swivelling head, spindle speeds 98 to 2,000 r.p.m.

**REED-PRENTICE** No. 6 Vertical Miller, table 84in. by 20in., centre of spindle to throat 28in., vertical head travel 9in., vertical spindle travel 11½in., max. spindle to table 32in., 12 spindle speeds 15 to 1,500 r.p.m., feeds 0.008in. to 0.280in.

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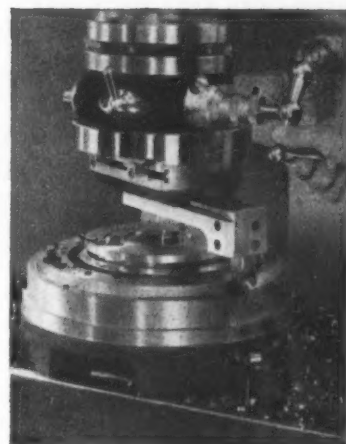
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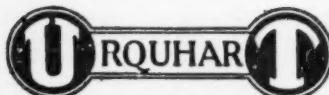
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**B. & S. OGG** S.S. Autos, 1942.  
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**CINCINNATI** 1L and No. 2 Vert. Mills, 1942.  
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## SITUATIONS VACANT

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ing posts are always available for technically trained men. Find out how you can put some letters after your name by preparing at home in "No Pass—No Fee" terms for A.M.I.Mech.E., A.M.I.Prod.E., A.M.S.E., City and Guilds, etc., etc. Full details of exams and hundreds of courses in all branches of Engineering, Draughtsmanship and Management, the Benefits of our Employment Dept., and unique record of 95 per cent. successes, are given in "Engineering Opportunities"—valuable 144-page Guide which will reveal many chances you are now missing. Write for your copy today stating (subject of interest).—FREE and without obligation.—B.L.E.T., Dept. 34a, Wright's Lane, London, W.8.

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Classified Advertisements (SITUATIONS VACANT, contd.)

**Machine Shop Foreman**  
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**Production-Minded Working Foreman**  
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merchants, new machines only, require Technical Representative for Midlands area. Must have connection. Salary, commission, car provided.—BOX Z54, MACHINERY, Clifton House, Euston Road, N.W.1.

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Representatives required for most areas to sell on a generous commission basis Small Tools and Machine Shop Equipment at highly competitive prices. Existing non-competitive representation not objected to.—Write in strictest confidence giving full details to BOX V946, MACHINERY, Clifton House, Euston Road, N.W.1.

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required on commission basis by versatile Birmingham Company engaged in Light Engineering Batch Production. Modern plant, A.I.D. approved, own Toolroom and D.O. facilities.—BOX Z32, MACHINERY, Clifton House, Euston Road, N.W.1.

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**Midland Company Engaged In**  
Cold Rolling Bright Steel Strip require Sales Representative for London. Must be experienced in the trade. Full details of past experience and connections, together with salary required to be stated.—BOX Z48, MACHINERY, Clifton House, Euston Road, N.W.1.

# SITUATIONS WANTED

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**Mechanical Engineer, 34,**  
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**Practical Engineer, 30 Year**  
experience in the Workshops. Machine and fitting, etc. General, Development, and Toolmaking. Administrative background with practical ability. Seeks position in practical field.—BOX Z56, MACHINERY, Clifton House, Euston Road, N.W.1.

## REPRESENTATIVE

**Technical Sales Representative**  
age 29, requires position with machine tools or small tools manufacturer. Midlands area. Wide engineering experience.—BOX Z49, MACHINERY, Clifton House, Euston Road, N.W.1.

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Frame Grinding Machine, motorised for 400-440/3/50 cycles supply.—BOX Z66, MACHINERY, Clifton House, Euston Road, N.W.1.

**Second-hand Taylor Hobson**  
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**Good Second-hand Combined**  
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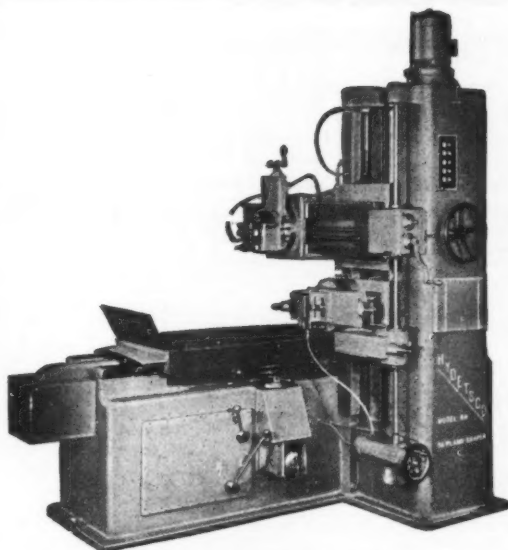
**Wanted Ward No. 7 Combination**  
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Kitchen & Wade No. 2 Honing Machine.  
Barber & Colman Gear Hobbing Machine.  
Only modern machines considered.—BOX Z61, MACHINERY, Clifton House, Euston Road, N.W.1.

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Mill, 41in. by 10in., 16 speeds 50-1,500, 415/3/50. £325.—C. DUGARD, LTD., Denmark Villas, Hove. 32471.

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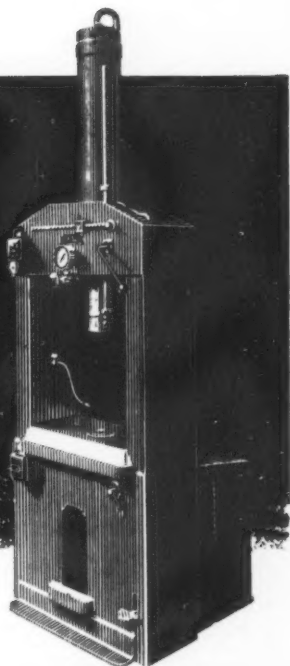
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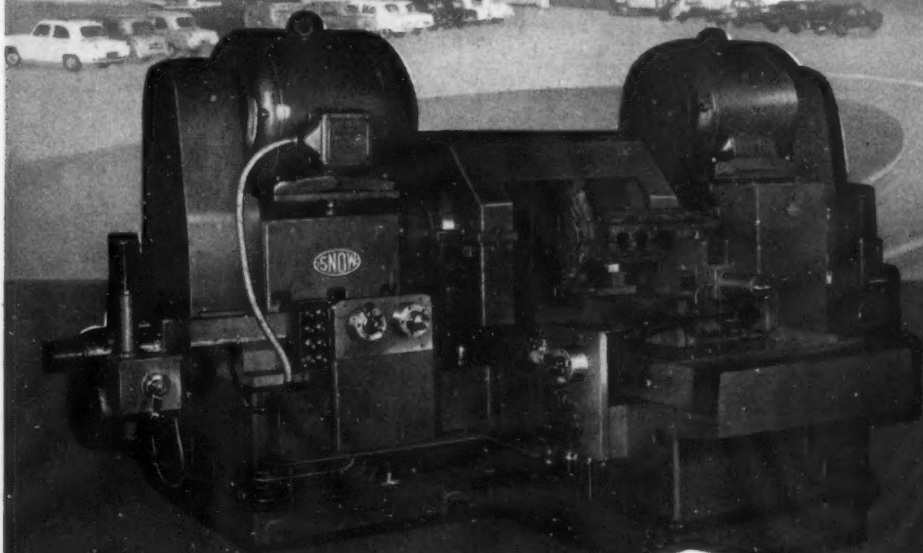
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